Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY
July 13, 1932

JUL 20 1932

This is an opportune time

TO MODERNIZE YOUR CEMENT PLANT

by technical improvements in layout and process and installation of modern economical machinery

● **to lower the cost of production and improve the quality of product** ●

without the necessity of increasing production.

Material prices are low. Labor is cheap.

Changes can be made with minimum interference to operation.

With 50 years of experience, specializing in the cement industry, F. L. Smidth & Co. are in position to render services pertaining to all phases of engineering for the cement industry, whether it be civil, mechanical, chemical or electrical.

In addition they manufacture a complete line of modern cement-making machinery, such as Unax Kilns, Unidan Mills, Uni-Koms, Agitators, Pumps, etc.

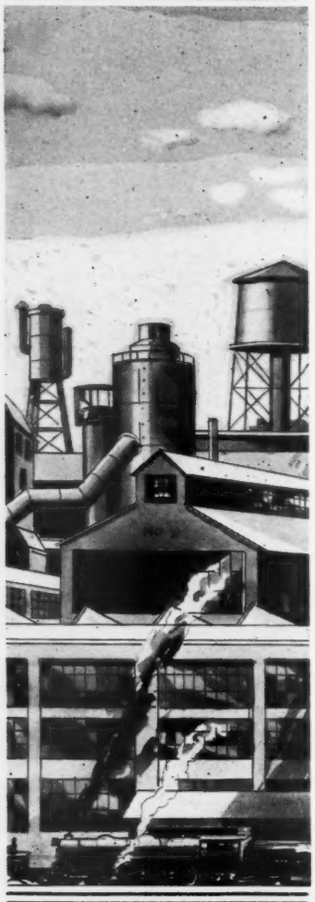
F. L. SMIDTH & CO.

Engineers

225 BROADWAY NEW YORK, N. Y.

SUPERIOR....

CRANKSHAFTS



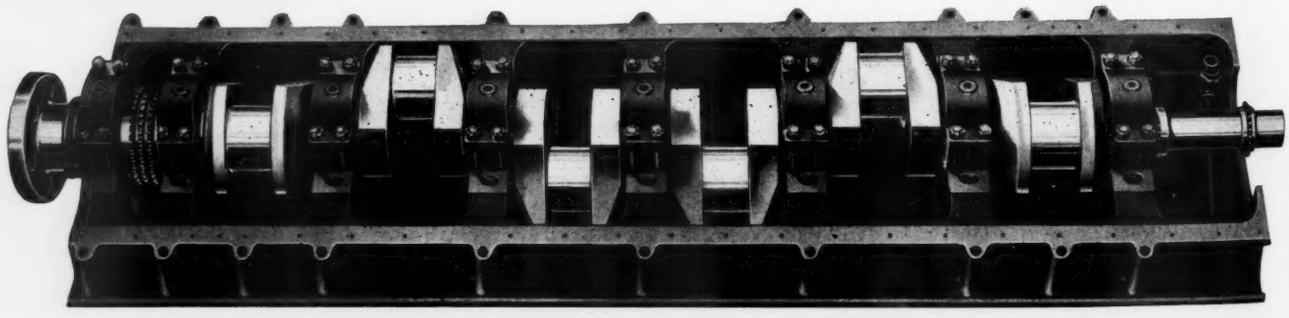
Never a broken Superior Crankshaft... a tribute to the correctness of design and excellence of construction of Superior Stationary Diesel Engines.

Superior crankshafts are forged from solid billets of vanadium steel, heat treated and machined all over. Shaft and crank pins are approximately 70 per cent of cylinder diameter.

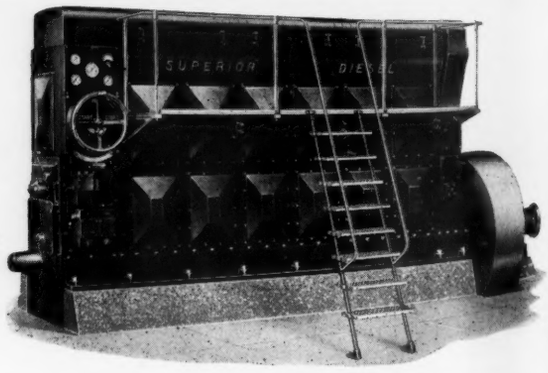
Shafts operate in bronze-backed, spun babbitt main bearings. Large shaft and ample bearing surface (one more bearing than number of cranks) is the best possible insurance against critical speeds and break-downs.

Bulletin No. 124-J gives full construction details and is free upon request.

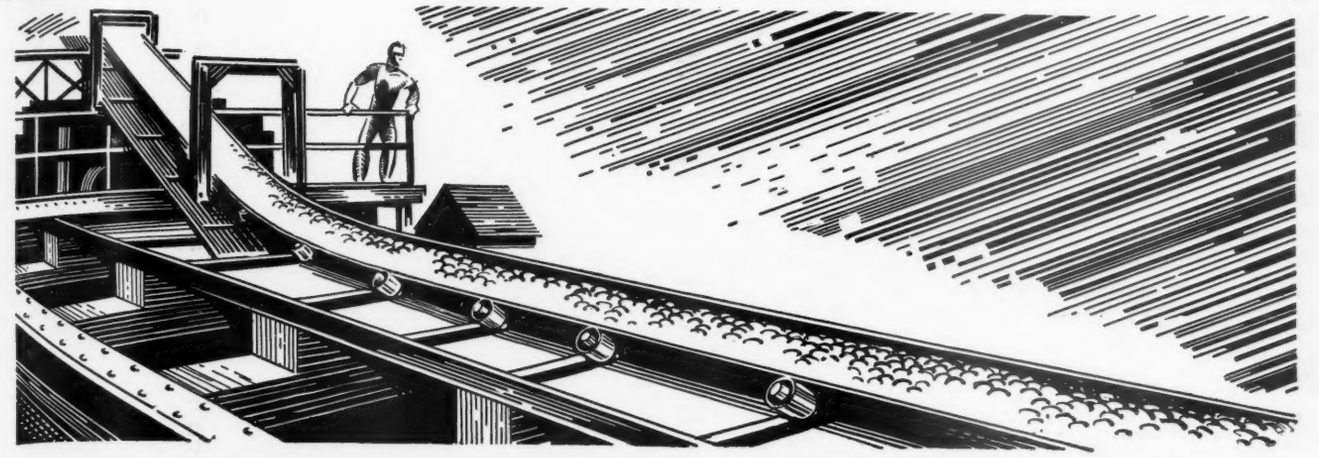
SUPERIOR ENGINE COMPANY, SPRINGFIELD, O.



SUPERIOR DIESEL STATIONARY ENGINES



PROVEN ECONOMY



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For eighty-six years New York Belting & Packing Company has built conveyor belts of unusual stamina and resistance against gruelling service. During this time these belts have found every possible opportunity of proving their true worth—of establishing amazing records for economy in operation.

The really *good* Conveyor — the kind *you* want — is the one that will take plenty of tough punishment — take it week after week — and then pay for itself on the cost sheet.

In every part of this country, N. Y. B. & P. conveyor belts have been establishing standards for long wear and trouble-free service. And — replacements tell the tale. Experienced buyers avoid the dangers of speculation by specifying N. Y. B. & P. quality.

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NEW YORK BELTING & PACKING CO. ★ FOUNDED 1846

Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Volume 24 July 13, 1932 Number 8

MEMBER AUDIT BUREAU OF CIRCULATIONS

Published bi-weekly on Wednesday for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other non-metallic minerals. Entered as second-class matter October 9, 1928, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

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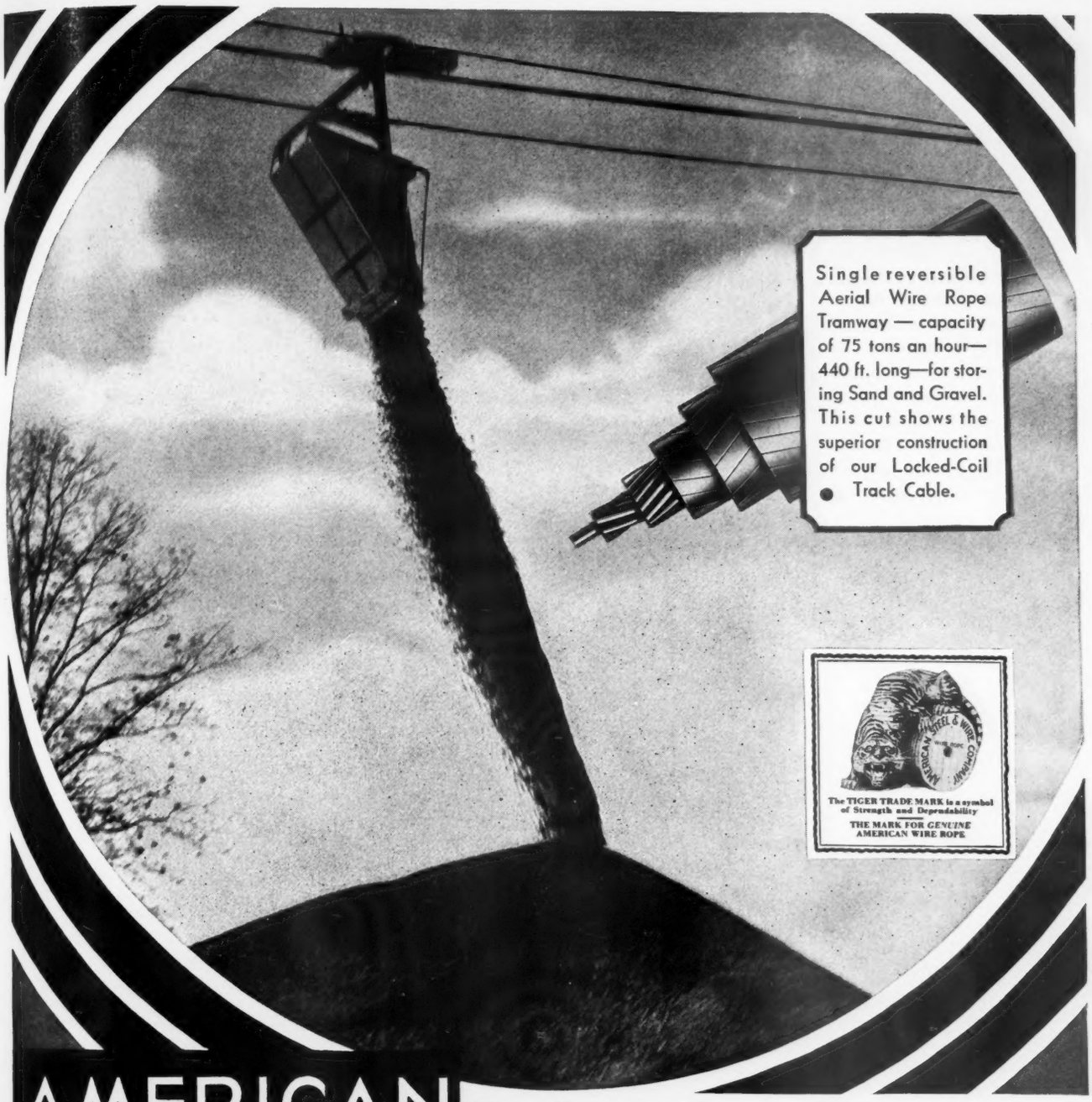
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AMERICAN
STEEL & WIRE COMPANY
AERIAL TRAMWAYS
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For Storing Sand—Gravel—Stone

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With no structures in the piles
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In Summer and Winter
With low operating cost
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Dependability with long life—in fact
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OVER FIFTY YEARS OF QUALITY WORKMANSHIP IS BACK OF EVERY LIMA SHOVEL, DRAGLINE, CRANE AND BACKDIGGER

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¾ Yard Shovel
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LIMA

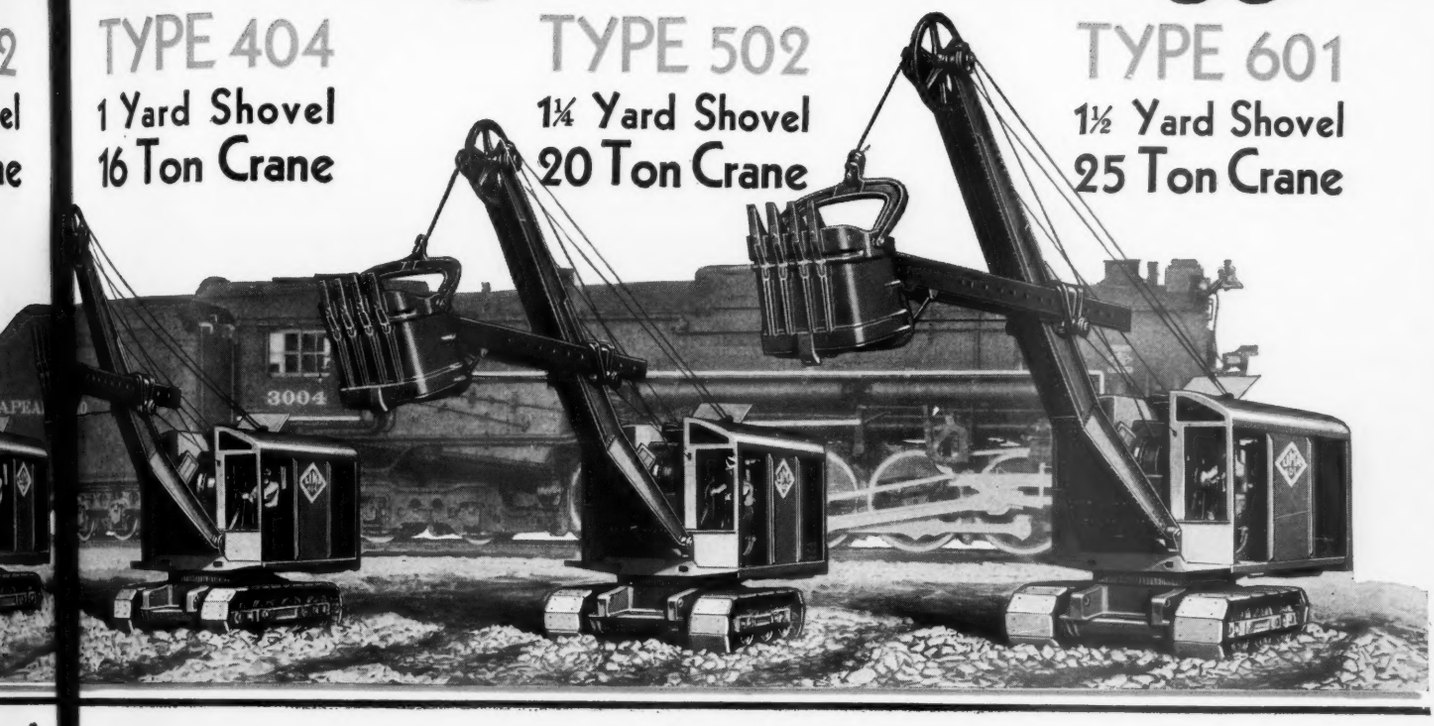
LIMA

Complete Line of LIMA Shovels-Cranes-Draglines and Backdiggers

TYPE 404
1 Yard Shovel
16 Ton Crane

TYPE 502
1¼ Yard Shovel
20 Ton Crane

TYPE 601
1½ Yard Shovel
25 Ton Crane



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101·302·404

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Please send me literature describing the

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(Check the type interested in)

Name _____

Address _____

City _____ State _____

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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Traylor Eng. & Mfg. Co.

Air Compressors
Fuller Co.
Traylor Eng. & Mfg. Co.

Air Pumps
Fuller Co.

Air Separators
Bradley Pulverizer Co.
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
Universal Road Machinery Co.

Asphalt
Standard Oil Co. (Indiana)

Automatic Feeders
Schaffer Poidometer Co.

Automatic Weighers
Schaffer Poidometer Co.

Babbitt Metal
Ryerson and Son, Inc., Joseph T.

Balls (Grinding)
Kennedy-Van Saun Mfg. & Engr. Corp.

Balls (Tube-Mill, etc.)
Allis-Chalmers Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Smidth & Co., F. L.

Belt Dressing
Dixon Crucible Co., Joseph

Belting
Manheim Mfg. & Belting Co.
New York Belting & Packing Co.

Bin Gates
Allis-Chalmers Mfg. Co.
Fuller Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

Bins (Steel)
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
McLanahan and Stone Corp.

Blast-Hole Drills (See Drills—Blast-Hole)

Blasting Machines
Hercules Powder Co.

Blasting Supplies
Atlas Powder Co.
Ensign-Bickford Co.
Hercules Powder Co.

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Jaeger Machine Co.

Borings, Core
Pennsylvania Drilling Co.

Bucket Elevators (See Conveyors and Elevators)

Buckets (Elevator and Conveyor)
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McLanahan and Stone Corp.
Smith Engineering Works

Cableways
American Steel & Wire Co.

Caps (Blasting)
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Capstans (See Winches and Capstans)

Carriers
Smith Engineering Works

Car Wheels—(See Wheels—Car)

Castings
Iowa Mfg. Co.
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McLanahan and Stone Corp.

Cement Pumps (See Pumps; Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Chain (Elevating and Conveying)
Cross Engineering Co.

Chutes and Chute Liners
Cross Engineering Co.
Iowa Mfg. Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
New York Belting & Packing Co.
Smidth & Co., F. L.

Clamshell Buckets (See Buckets—Clamshell, Orange-peel, etc.)

Clamshell Gates (See Gates-Clamshell)

Classifiers
Allen Cone and Machy. Corp.
Bradley Pulverizer Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machine Co.

Clips (Wire Rope)
American Steel & Wire Co.

Coal-Pulverizing Equipment
Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
Gay Co., Inc., Rubert M.
Kennedy-Van Saun Mfg. & Engr. Corp.
Smidth & Co., F. L.

Compressors (See Air Compressors)

Cones (Sand-Washing)
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Conveyor Belting (See Belting)

Conveyors and Elevators
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Cross Engineering Co.
Fuller Co.
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.

Conveyor Idlers and Rolls
Iowa Mfg. Co.

Conveyors (Ready Mixed Concrete)
Jaeger Machine Co.

Coolers (See Kilns and Coolers—Rotary)

Correcting Basins
Smidth & Co., F. L.

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Westinghouse Electric & Mfg. Co.

Cranes (Crawler and Locomotive)
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Crusher Parts
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McLanahan and Stone Corp.

Crushers (Hammer)
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Kennedy-Van Saun Mfg. & Engr. Corp.

Crushers (Jaw and Gyratory)
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Crushers (Roll)
Allis-Chalmers Mfg. Co.
Gruendler Crusher and Pulverizer Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
McLanahan and Stone Corp.

Crushers (Rotary)
Allis-Chalmers Mfg. Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
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McLanahan and Stone Corp.
Traylor Eng. & Mfg. Co.

Detonators
Hercules Powder Co.

Diesel Engines (See Engines—Diesel)

Dragline Excavators
Ohio Power Shovel Co.

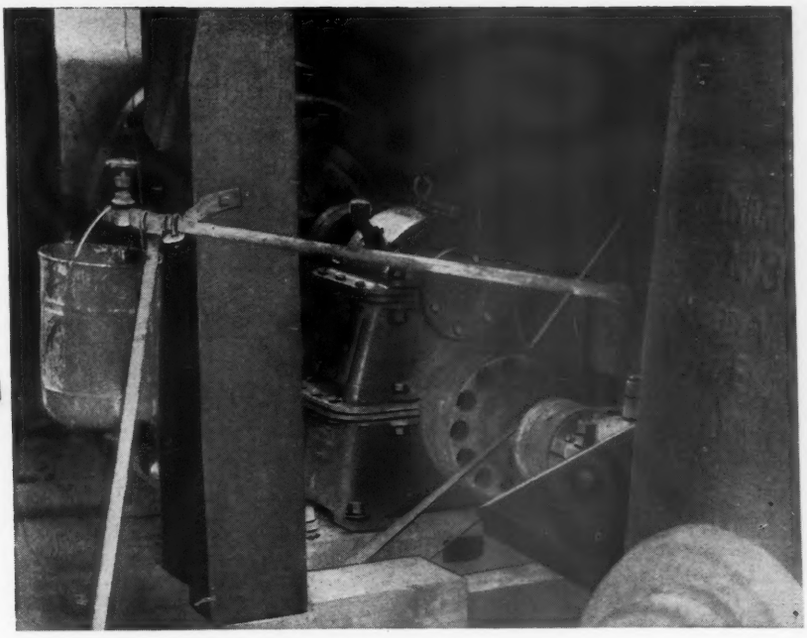
Dredge Chain (See Chain)

Dredge Pipe (See Pipe)

Dredges
Morris Machine Works

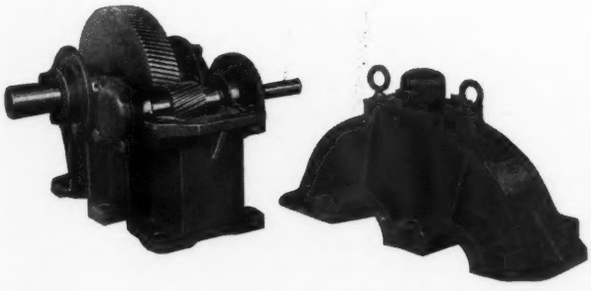
Drilling Accessories
Loomis Machine Co.

The Westinghouse-Nuttall Speed Reducer has been giving trouble-free service on this gyratory crusher drive at the Millwood Sand Company, Latrobe, Pa., since 1925.



Proved IN CRUSHER DRIVE SERVICE ...W-N Speed Reducers

NO ROCK products operation is a more severe test for speed reducers than a primary crusher drive with its terrific pounding loads, sharp impacts and sudden strains. In this severe service, Westinghouse-Nuttall speed reducers have proved their ability to give years of dependable power transmission with no upkeep other than occasional oiling.



Latest type Westinghouse-Nuttall Single Reduction Speed Reducer equipped with Helical Gears and Roller Bearings.

The successful performance of W-N units is due mainly to their unusual ruggedness. All parts are built not only to carry full rated load continuously but also to stand 100% overload intermittently.

Equipped with helical gears—the most efficient type known—and roller bearings, Westinghouse-Nuttall speed reducers deliver power at 96 to 98% efficiency, depending upon the number of reductions. Being impervious to dust, grit and moisture, their high efficiency is maintained through years of service.

Specify Westinghouse-Nuttall speed reducers for any rock products operation, and be assured of efficient, dependable drives.

Standardized types with ratios of 2.82:1 to 70.5:1 are available for drives of 1 to 635 hp.

Ask for full details at the nearest Westinghouse sales office or simply mail the coupon.

T 79281 **Westinghouse**

Quality workmanship guarantees every Westinghouse product

SEND FOR INFORMATION

Westinghouse Electric & Manufacturing Company
Room 2-N—East Pittsburgh, Pa.
Gentlemen: Please send L. 20472 and C. 1891—Westinghouse-Nuttall Speed Reducers.

Name .....
Company .....
Address .....
City ..... *State* ..... PQ 7-13-32

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Loomis Machine Co.

Drills, Diamond
Pennsylvania Drilling Co.

Drills (Rock)
Loomis Machine Co.

Drills (Well) (See Drills—Blast-Hole)

Drives (Multiple Belt, Chain, Rope)
Allis-Chalmers Mfg. Co.

Dryers
Allis-Chalmers Mfg. Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Fdry. & Mach. Co.
McLanahan and Stone Corp.
Traylor Eng. & Mfg. Co.

Dust Collecting Systems
Allis-Chalmers Mfg. Co.

Dust-Conveying Systems
Fuller Co.

Dust Hoods and Helmets
Pulmosan Safety Equipment Co.

Dynamite (See Explosives)

Electrical Equipment
Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.

Elevators (See Conveyors and Elevators)

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Engineers
Allen Cone and Machy. Corp.
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Cross Engineering Co.
Fuller Co.
Iowa Mfg. Co.
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McLanahan and Stone Corp.
Smidth & Co., F. L.

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Engines (Internal-Combustion)
Superior Engine Co.

Engines (Steam)
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Hercules Powder Co.

Fans (Exhaust)
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Feeders
Allis-Chalmers Mfg. Co.
Fuller Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Morrow Mfg. Co.
Smith Engineering Works

Filter Cloth
Oliver United Filters, Inc.

Filters (Cement Slurry)
Oliver United Filters, Inc.

Fuses (Detonating)
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Hercules Powder Co.

Gaskets
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Generators (See Motors and Generators)

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Goggles
Pulmosan Safety Equipment Co.

Grab Buckets (See Buckets—Clamshell, Orange-Peel, etc.)

Graphite
Dixon Crucible Co., Joseph

Greases
Dixon Crucible Co., Joseph
Standard Oil Co. (Indiana)

Grinding Balls (See Balls, Grinding)

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Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Fdy. & Mach. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Guns (Hydraulic)
Georgia Iron Works

Hammer Mills (See Crushers—Hammer)

Hoists
Iowa Mfg. Co.
McLanahan and Stone Corp.
Smith Engineering Works

Hose (Air, Steam and Water)
New York Belting & Packing Co.

Hose Couplings (See Couplings)

Hydraulic Guns (See Guns—Hydraulic)

Idlers
Allis-Chalmers Mfg. Co.
Smith Engineering Works

Kilns and Coolers (Rotary)
Allis-Chalmers Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Smidth & Co., F. L.
Traylor Eng. & Mfg. Co.

Kominuters
Smidth & Co., F. L.

Lime-Handling Equipment
Fuller Co.
Iowa Mfg. Co.

Lime Kilns
Kennedy-Van Saun Mfg. & Engr. Corp.

Linings (Ball- and Tube-Mill) (See Mill Liners and Linings)

Loaders and Unloaders
Fuller Co.

Locomotives (Electric, Gas and Steam)
Lima Locomotive Works.
Westinghouse Electric & Mfg. Co.

Lubricants
Dixon Crucible Co., Joseph
Standard Oil Co. (Indiana)

Magnetic Clutches (See Clutches, Magnetic)

Mill Liners and Linings
Kennedy-Van Saun Mfg. & Engr. Corp.
New York Belting & Packing Co.
Smidth & Co., F. L.

Mills (Grinding) (See also Crushers—Hammer)
Allen Cone and Machy. Corp.
Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Fdy. & Mach. Co.
Smidth & Co., F. L.
Traylor Eng. & Mfg. Co.

Motors and Generators
Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.

Motors (Internal-Combustion) (See Engines—Internal-Combustion)

Nails
American Steel & Wire Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Oils (Graphite)
Standard Oil Co. (Indiana)

Oils (Motor)
Standard Oil Co. (Indiana)

Ore Separators
Allen Cone and Machy. Corp.

Oxygen (Liquid) (See Liquid Oxygen)

Packing
New York Belting & Packing Co.

Perforated Metal Plates
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Cross Engineering Co.
Morrow Mfg. Co.

Pipe Flanges
Georgia Iron Works

Plug Valves (See Valves)

Pneumatic Drills (See Drills, Rock)

Poidometers
Schaffer Poidometer Co.

Portable Conveyors
Fuller Co.
Iowa Mfg. Co.

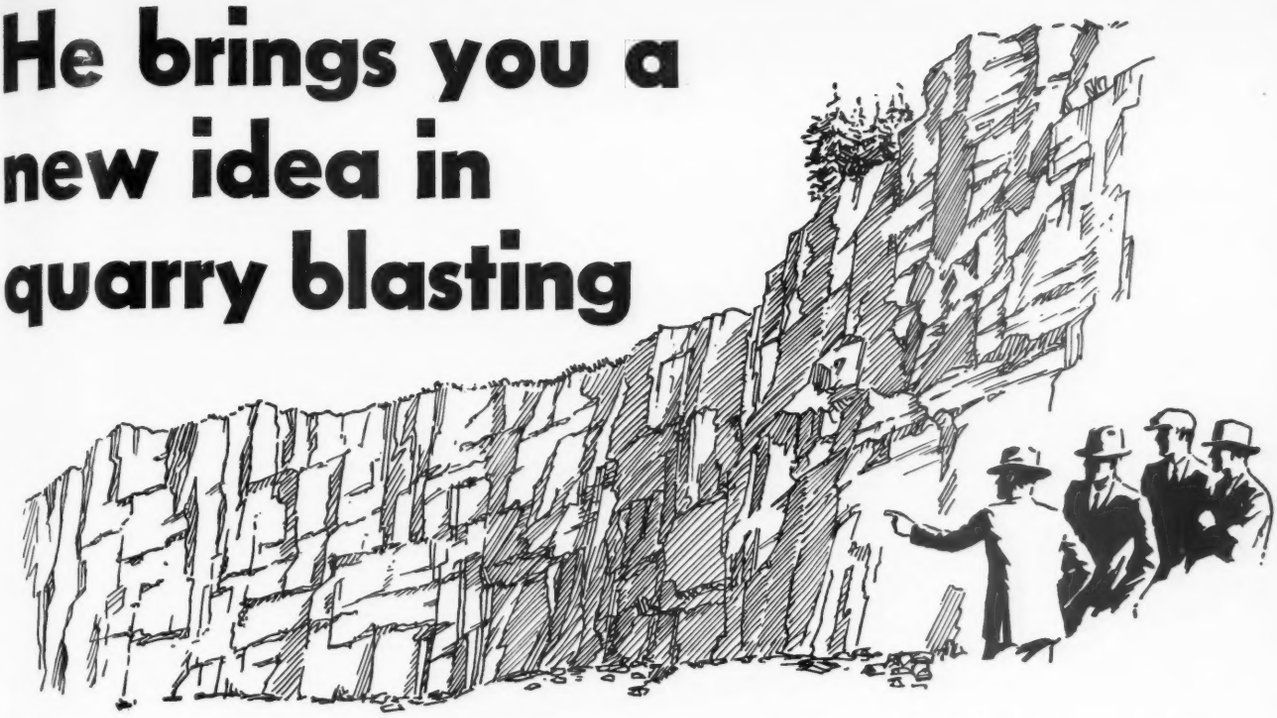
Portable Engines (See Engines—Internal Combustion)

Portable Loaders (See Loaders and Unloaders)

Power Cable (Rubber Clad)
American Steel & Wire Co.

Power Shovels (See Shovels, Electric, Internal-Combustion and Steam)

He brings you a new idea in quarry blasting



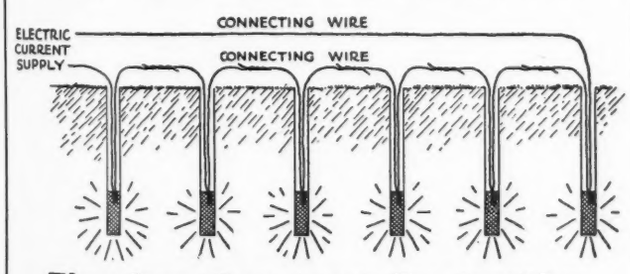
He brings a method in tune with the times—providing more satisfactory blasting at less cost. It is a scientific method perfected in the laboratory and proven by field tests. He is the Atlas representative, ready with evidence to prove the advantages of electric blasting in quarrying.

Primary action in a horizontal direction from well drill quarry charges assures toe burden disruption, good fragmentation, controlled back breaks, limited throw and less noise from blasting. The Atlas representative can prove that electric blasting will provide these benefits at a worth while saving in blasting costs. It is all due to the "team-work" secured by the use of electric blasting caps. But . . . get the complete story. . .

WRITE FOR THE FREE FOLDER,
"THEY MUST PULL TOGETHER"

Learn why slight variations in the firing of well drill hole charges increase the cost of rock production.

THEY MUST PULL TOGETHER . . .



Therefore they must fire together

Progressive firing or the firing of one charge before another produces relief to adjoining charges as evidenced by "gunning-out" or trenching action along the line of bore holes. Electric Blasting reduces this "gunning-out" action—increases the effectiveness and decreases the cost of the blast.

ATLAS POWDER COMPANY
A proper explosive for every blasting requirement
WILMINGTON, DELAWARE

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Allentown, Pa.; Boston, Mass.; Charleston, W. Va.; Denver, Colo.; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.; Memphis, Tenn.; New Orleans, La.; New York, N. Y.; Norristown, Pa.; Philadelphia, Pa.; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis, Mo.; Tamaqua, Pa.; Wilkes-Barre, Pa.

ATLAS EXPLOSIVES

ATLAS
EXPLOSIVES

ON THE WEST COAST WRITE THE GIANT POWDER CO., Cons., San Francisco, Cal.

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Index to Advertisers on Page 68

Proportioning Equipment
Schaffer Poidometer Co.

Pulverized Fuel Systems
Gay Co., Rubert M.
Kennedy-Van Saun Mfg. & Engr. Corp.

Pulverizers (See also Crushers; Mills; etc.)
Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
Gruendler Crusher and Pulverizer Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
Smidth & Co., F. L.

Pump Valves (See Valves, Pump)

Pumps (Air-Lift)
Fuller Co.

Pumps (Bulk Cement)
Fuller Co.

Pumps (Cement Slurry)
Morris Machine Works
Smidth & Co., F. L.

Pumps (Centrifugal)
Allen Cone and Machy. Corp.
Allis-Chalmers Mfg. Co.
Georgia Iron Works
Morris Machine Works

Pumps (Dredging)
Allis-Chalmers Mfg. Co.
Georgia Iron Works
Morris Machine Works

Pumps (Sand and Gravel)
Allen Cone and Machy. Corp.
Allis-Chalmers Mfg. Co.
Georgia Iron Works
Morris Machine Works

Pumps (Vacuum)
Fuller Co.

Purifiers, Steam (See Steam Purifiers)

Respirators
Pulmosan Safety Equipment Co.

Rock Drills (See Drills—Rock)

Rod Mills
Kennedy-Van Saun Mfg. & Engr. Corp.
Traylor Eng. & Mfg. Co.

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Ryerson and Son, Inc., Joseph T.

Rope (Wire) (See Wire Rope)

Rubbish Burners
Cross Engineering Co.

Safety Equipment
Pulmosan Safety Equipment Co.

Sand Separators
Allen Cone and Machy. Corp.
McLanahan and Stone Corp.
Smith Engineering Works

Sand-Settling Tanks
Allen Cone and Machy. Corp.
Iowa Mfg. Co.
Smith Engineering Works

Scrapers (Power Drag)
Iowa Mfg. Co.

Screens
Allen Cone and Machy. Corp.
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Cross Engineering Co.
Deister Machine Co.
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.

Screens (Vibrating or Shaking)
Allen Cone and Machy. Corp.
Deister Machine Co.
Gay Co., Inc., Rubert M.
Gruendler Crusher and Pulverizer Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.

Separators (Air) (See Air Separators)

Separators (Slurry)
Smidth & Co., F. L.

Sheaves
Allis-Chalmers Mfg. Co.
Gruendler Crusher and Pulverizer Co.
McLanahan and Stone Corp.

Shovels (Electric, Internal-combustion and Steam)
Ohio Power Shovel Co.

Silos
Smidth & Co., F. L.

Skip Hoists and Skips
Allis-Chalmers Mfg. Co.

Solvents (Carbon)
Standard Oil Co. (Indiana)

Speed Reduction Units
Iowa Mfg. Co.
Westinghouse Electric & Mfg. Co.

Spouts (See Chutes and Chute Liners)

Sprockets and Chains
Iowa Mfg. Co.

Steel (Bars, Shapes, Plates, etc.)
Ryerson and Son, Inc., Joseph T.

Steel Inclines (See Inclines, Steel)

Steel Grating (See Grating, Steel)

Tanks (Sand-Settling)
Allen Cone and Machy. Corp.
Iowa Mfg. Co.
Morrow Mfg. Co.
Smith Engineering Works

Tools (Drill) (See Drilling Accessories)

Tractors
Allis-Chalmers Mfg. Co.

Tramways (Aerial)
American Steel & Wire Co.

Transformers
Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.

Transmission Belting (See Belting)

Transmission Machinery
Allis-Chalmers Mfg. Co.
Gruendler Crusher and Pulverizer Co.

Truck Cranes (See Cranes)

Truck Mixers
Jaeger Machine Co.

Tube Mills (See Mills—Ball, Tube, etc.)

Tube-Mill Liners (See Mill Liners and Linings)

Underground Loaders
Allis-Chalmers Mfg. Co.

Unloaders (Box Car)
Fuller Co.

Valves (Pump)
Manheim Mfg. & Belting Co.

Vibrating Screen Plate
Chicago Perforating Co.
Cross Engineering Co.
Morrow Mfg. Co.

Vibrating Screens (See Screens—Vibrating)

Washers (Sand, Gravel, and Stone)
Allen Cone and Machy Corp.
Allis-Chalmers Mfg. Co.
Iowa Mfg. Co.
Kennedy-Van Saun Mfg. & Engr. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Smidth & Co., F. L.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.

Weighing Equipment (Automatic)
Schaffer Poidometer Co.

Welding Supplies
American Steel & Wire Co.
Westinghouse Electric & Mfg. So.

Well Drills (See Drills—Well)

Wheels (Car)
Iowa Mfg. Co.

Wire-Rope Fittings
American Steel & Wire Co.
Williamsport Wire Rope Co.

Wire and Cable (Electric)
American Steel & Wire Co.

Wire Rope
American Steel & Wire Co.
Williamsport Wire Rope Co.

Wire Rope Slings
American Steel & Wire Co.
Williamsport Wire Rope Co.

Wire (Welding)
American Steel & Wire Co.

Worm Gears (See Gears and Pinions)

5 causes of hot motor bearings result directly or indirectly from incorrect lubrication

HOT bearings are one of the most frequent reasons for electric motor trouble. Of the ten major causes of hot bearings, five result directly or indirectly from lubrication. What these lubrication troubles are and how to remedy them is explained in a technical monograph on electric motor lubrication being published this month by the Standard Oil Company (Indiana) which is available upon request.

Any lubrication remedy for hot motor bearings, any hope of trouble free motor lubrication depends upon effective lubricants. So wide is the variety of electric motors and so varied are the conditions under which they operate that in order to meet every possible lubrication requirement, we have developed thirteen distinct electric motor lubricants.

Under most normal operating conditions, Superla Dynamo Oil, Polar Machine Oil or Superla X Greases will provide efficient, economical motor lubrication. They are highly refined pure mineral lubricants. All are unusually stable and resist sludging and gumming during continuous use over long periods of time.

If you have any hot running motors in your plant the trouble may be lubrication. Our engineers can tell quickly whether the lubrication is at fault—call in one of these men. His recommendations backed by years of experience plus the added advantage of a wide range of approved lubricants assures you of effective, economical motor lubrication.

MONOGRAPHS ON LUBRICATION

Each month the Standard Oil Company (Indiana) publishes a technical monograph on the lubrication of some particular type of equipment. Three monographs already have been published. They are "Reducing Lubrication Costs," "Lubricating the Corliss Valve Steam Engine," "Electric Motor Lubrication." A copy of any or all monographs will be sent to you at your request.

STANDARD OIL COMPANY (INDIANA)

910 SOUTH MICHIGAN AVENUE — CHICAGO, ILLINOIS

1706

Decatur	Detroit	Fargo	Huron	Kansas City	Mason City	Minot	Saginaw
Denver	Duluth	Grand Rapids	Indianapolis	La Crosse	Minneapolis	Peoria	Sioux City
Des Moines	Evansville	Green Bay	Joliet	Mankato	Milwaukee	Quincy	South Bend

WILLIAMSPORT
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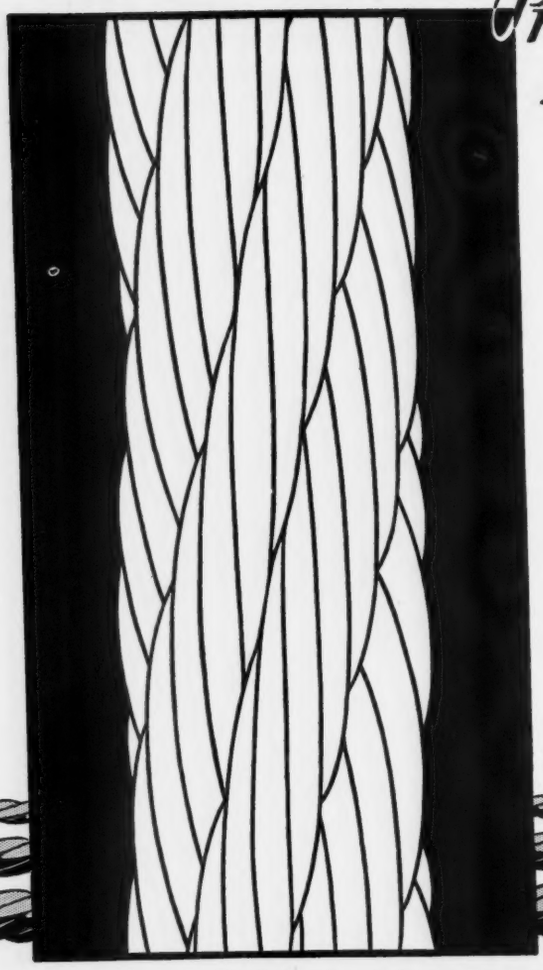

Proves worthy under
Any Condition!

This age of Specialization has entered into the manufacture of wire rope by Williamsport.

All of this is directed towards longer life and more efficient service.

It is to your interest to write us for information as to how this will effect economies in your service. Will you write us today—outlining your problems? We may be able to give you valuable assistance.

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WIRE ROPE COMPANY

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General Sales Offices:
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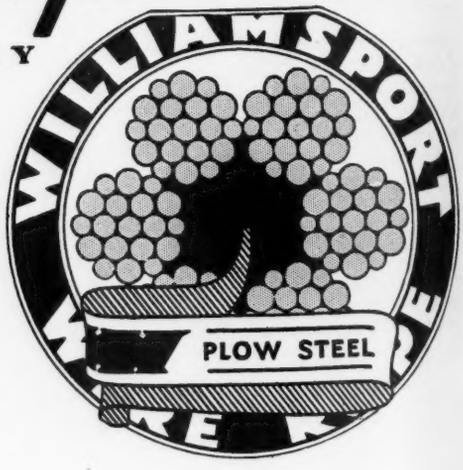
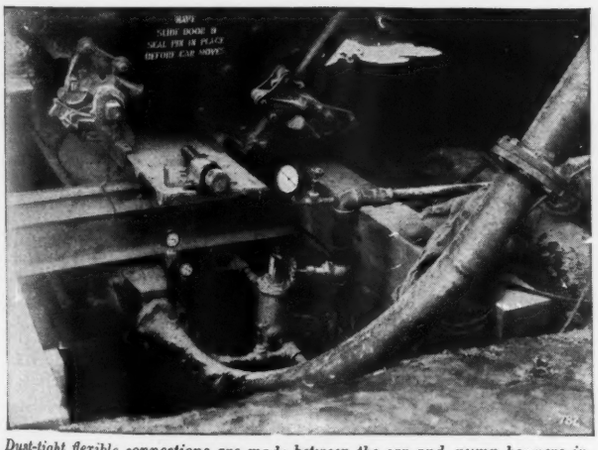
CHICAGO



A NEW FULLER-KINYON PUMP

LOW AIR PRESSURE - LOWER POWER
LOWEST COST PER TON

Unloading bulk cement from a hopper-bottom car. The simplicity of the equipment adapts it to construction and permanent mixing plants.



Dust-tight flexible connections are made between the car and pump hoppers in the same manner as between weigh bins and mill-type Fuller-Kinyon Pumps.

The Type "F" Pump is installed below the rails in a shallow pit. It may be driven by either a gas engine or an electric motor.

Substantially increased savings in the use of bulk cement and the handling of pulverized materials at the mill are obtainable with this new Fuller-Kinyon Pump. Savings are made in power per ton conveyed, in the initial cost of the apparatus and its installation, operation and maintenance. The total power compares favorably with the requirements of mechanical conveyors for the shortest distances, as from a car hopper to a bin adjacent to the track. Beyond these short distances, increasing power savings are obtained, and the possible conveying distance exceeds considerably the practical limits of mechanical conveyors. The initial cost of the equipment compares favorably with other conveyors of the same capacity, even for short distances; while for long distances they are considerably cheaper.

The new pump operates at very low air pressures, and has a number of new mechanical features of interest to the cement manufacturer, to whom it is offered as a lower cost conveyor for short and medium distances. A new circular describes the savings obtainable, and the mechanical features of this pump.

Fuller Company
CATASAUQUA, PENNA. U. S. A.

CEMENT WEIGHING BATCHERS
PNEUMATIC CONVEYORS
COMPRESSORS

STATIONARY and PORTABLE **FULLER-KINYON** ***CONVEYING SYSTEMS***

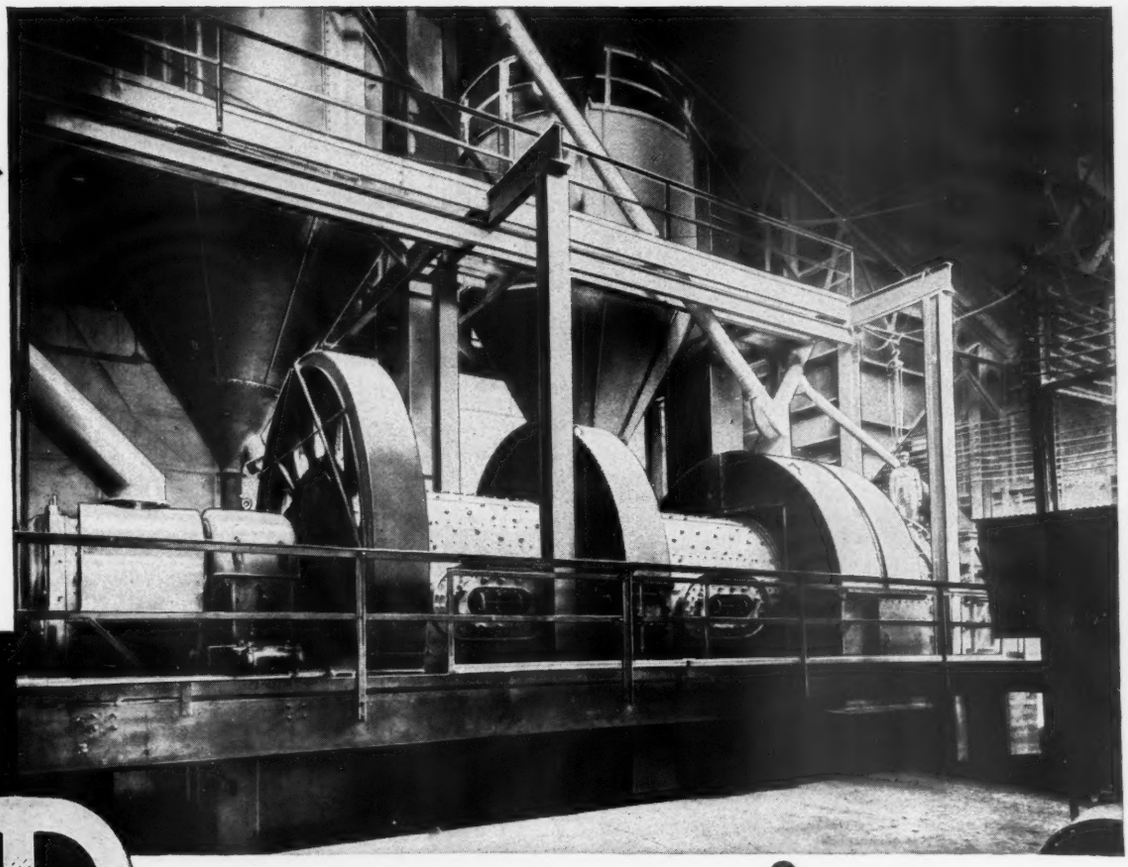
FIRE *WHEN READY!*

And not before! Danger of premature shots during loading is minimized because Cordeau-Bickford Detonating Fuse *must be detonated* — it cannot be set off by fire, friction or any ordinary shock. The blasting cap is applied *after* the hook-up, which follows the loading. You fire *when ready,* and not before.

Since Cordeau-Bickford is the detonating agent, in contact with each cartridge, the entire charge has the high efficiency of a primer cartridge — a factor that is considered when planning the holes and loads.

The use of Cordeau-Bickford means added safety, added efficiency, added economy. It has made the giant blast possible and profitable. The Ensign-Bickford Company, Simsbury, Conn.

CORDEAU
DETONATING FUSE
BICKFORD



Progressive Grinding...

... used only in Allis-Chalmers Compeb Mills, equipped with air classifiers, satisfies the most exacting requirements of present day cement manufacturers. One mill so equipped, will replace several preliminary and finishing mills.

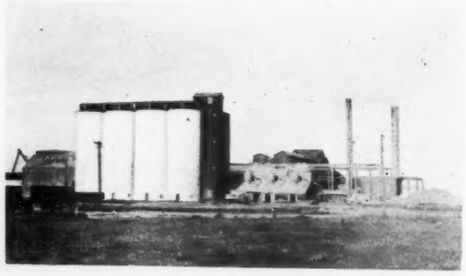
Progressive Grinding results in low power consumption and permits a wide range of fineness control, including the requirements of high early strength cement.

The saving in power, attendance and operating expense resulting from **Progressive Grinding** is possible only through the use of Allis-Chalmers Compeb Mills. Only **Compeb Mills** embody all of the features of design and construction necessary for **Progressive Grinding.**

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

ALLIS-CHALMERS

Aetna Reduces Production Costs!

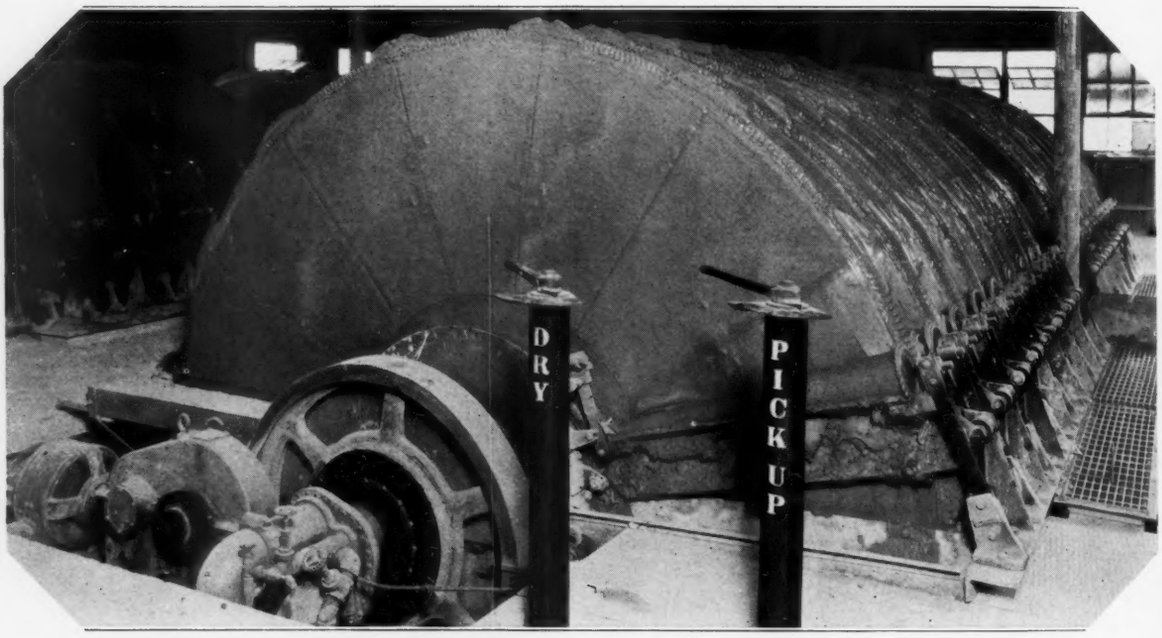


A modern wet process cement plant requires Oliver United filters.

To compete with present market conditions, the Aetna Portland Cement Company have completely equipped their Bay City plant with American filters, reducing by 25% the fuel used to burn each barrel of clinker.

Two-thirds of former plant capacity can now be produced by one kiln equipped with filters. The plant capacity before was 2400 barrels — now 3200 barrels.

Such economies represent fuel payments you make month after month which can be paying for Oliver United cost-reducing equipment.



4—12'-6", 8 DISC AMERICAN FILTERS OVER 2 AETNA KILNS

Aetna is one of twenty-four completely Oliver United filter-equipped cement plants, every one effecting predicted fuel economies, and kiln production.

Our engineers will be glad to determine how inexpensively Oliver United filters can be installed in your plant and how quickly fuel savings will return the investment.

OLIVER UNITED

OLIVER UNITED FILTERS INC.

New York
33 W. 42nd St.

Chicago,
LaSalle Wacker Bldg.

San Francisco,
Federal Reserve Bank Bldg.

Toronto,
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Soerabaja, Java

Ayres & Son
Recife, Brazil

Affiliated with THE DORR COMPANY, INC., *Engineers*

VOLUME 24 NUMBER 8

Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

CHICAGO, JULY 13, 1932

Committees Propose Standards Revision

REPORT AT A. S. T. M. MEETING

Recommendation that four standards and three tentative standards be revised composed the report of Committee C-9 on Concrete and Concrete Aggregates, presented at the annual meeting of the American Society for Testing Materials, held at Atlantic City June 20-24. These included "Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field," "Standard Methods of Making Compression Tests of Concrete," "Standard Method of Test for Organic Impurities in Sands for Concrete," and "Standard Method of Test for Sieve Analysis of Aggregates for Concrete."

Tentative standards regarding which the committee urged some revision included "Tentative Method of Test for Structural Strength of Fine Aggregate Using Constant Water-Cement-Ratio Mortar," "Tentative Method of Test for Soundness of Fine Aggregates by Use of Sodium Sulphate" and "Tentative Method of Test for Soundness of Coarse Aggregates by Use of Sodium Sulphate." The committee also presented a suggested procedure for carrying out freezing-and-thawing tests of concrete and aggregates.

R. E. Davis and R. W. Carlson, University of California, described a new type of strain-measuring instrument which will enable engineers to study strain and temperature conditions within large masses of concrete. Calibration studies of instruments embedded in concrete have been carried out and a consistent agreement was shown with results obtained by means of a mechanical strain gage.

"Volume Changes of an Early-Strength Concrete" was the title of a paper by E. R. Dawley, Kansas State College of Agriculture. He pointed out that the coëfficient of thermal expansion proved to be more affected by the kind of coarse aggregate than by the kind or amount of cement. Freezing-and-thawing tests indicated that specimens made with early-strength cement were more durable than those made with ordinary Portland cement.

Committee C-1 on Cement, in its report, presented a revision of "Standard Methods of Testing Cement" and of "The Manual of Cement Testing." The committee also recommended the withdrawal of "Tentative Specifications and Tests for Compressive Strength of Portland-Cement Mortars." An appendix to the report included a study of all tests known regarding the effects of using hot cement in making concrete and a report of the activities, which the committee is partly financing, of the Cement Reference Laboratory at the U. S. Bureau of Standards.

A subcommittee, which has been studying the effect of the use of hot cement, reported that "on account of the low specific heat of Portland cement and of its relatively small quantity in the usual mix, the temperature at the time of use of cement of normal properties appears to be a minor factor in producing high temperatures of freshly mixed concrete under usual job conditions.

Two Firms in Salt Lake City Add Improvements

While business men in many lines have been curtailing operations because of the depression, the owners of the Stauffer Sand & Gravel Co., Salt Lake City, Utah, recently decided that the present is a good time to expand, so they have spent about $12,000 in placing the plant on a sound commercial basis after having been operated for a long time largely for railroad-ballast purposes. The plant is now thoroughly up-to-date.

The new equipment includes two vibrating screens, an elevator, a conveyor, and a new storage bin.

The Utah Sand & Gravel Products Corp., of Salt Lake City, also owned by the Stauffer interests, has also improved its plant, spending about $2,500 for a new vibrating screen, and practically reconstructing its storage bins.

Structural Gypsum Corp. Acquires Zenitherm Co.

Negotiations have been concluded by the Structural Gypsum Corp., of New York, N. Y., a subsidary of the American Cyanamid Co., whereby it will acquire the assets and business of the Zenitherm Co., Inc., manufacturers of ornamental floor and wall tile.

N. Y. Firm Buys Rock Deposit at Catskill

MAY BE CEMENT-PLANT SITE

Approximately 140 acres of land containing limestone deposits at Catskill, N. Y., have been acquired by the Metropolitan Cement Corp., of New York, N. Y., a subsidiary of the Edison Cement Corp.

No announcement as to the development of the tract has been forthcoming but it is rumored that acquisition of the land was made at an attractive price and that the company will hold it as the site of a Portland-cement plant and quarry, construction to be undertaken at such time as general conditions, and particularly the building industry, get back to normal.

The Metropolitan interests some time ago acquired a huge potash plant on the Raritan River, near Stewardsville, N. J., and are reported to be investing more than a half-million dollars in converting it into a modern wet-process cement plant.

Hiram Norcross, Cement Executive, Resigns Post

Hiram Norcross, vice-president and a director of the Missouri Portland Cement Co., has announced his resignation from the company. Mr. Norcross has long been active in the cement industry and had taken a prominent part in the affairs of the Portland Cement Assn. He came to the Missouri organization in 1928. Previous to that time he had been connected with the Consolidated Cement Corp., at Chicago and its management affiliate, the Cowham Engineering Co. Another of his activities was the direction of the Norcross Statistical Bureau.

Universal Atlas Opens Buffington, Ind. Plant

After having been closed down entirely for two months, the plant of the Universal Atlas Cement Co., at Buffington, Ind., is reported to have resumed operations on a reduced basis. Three kilns were fired on June 21 with indications pointing to production through the summer.

New Quarry Opened by Greely Stone Co.

PLANT IS NEARLY COMPLETED

The Greely Stone Co. has near completion at Russellville, Ky., one of the finest crushed-stone plants in that section. R. E. Greely, president of the company, for many years operated a plant at St. Paul, Ind. The deposit at that location became exhausted and this plant was abandoned early in 1930. Looking about for a suitable location Mr. Greely decided to build a new plant in Kentucky because of the large road-construction and railway-ballast program scheduled for that state and its neighbor, Tennessee.

The deposit selected is located two miles northwest of Russellville and consists of a good grade of limestone similar to that quarried by a number of other plants in the vicinity. Construction of the new plant was begun in September, 1930, and by the latter part of 1931 it was near completion. Since that time little progress has been made, but it is now planned to finish the plant during the present season.

A quarry face 30 ft. high has been opened on the 50-acre property. All the concrete for the plant is in place.

The screening-and-storage building.

This includes the plant foundations, the crusher foundations and the 7-compartment, 900-ton capacity concrete storage bin. The timber plant, conveyor, elevator framework and the surge bins have been erected. The Allis-Chalmers McCully No. 9 gyratory primary crusher is in place in a pit cut from solid rock. The McCully No. 7½ secondary crusher is also in place and provisions have been made for the installation of a reduction crusher.

The machine and blacksmith shop has been completed and is equipped with machinery for making practically all necessary repairs. Equipment includes a lathe, power drill, forge, etc., as well as a complete stock of repair parts. The hauling equipment in the quarry consists of two Plymouth gasoline locomotives and ten 3-cu.yd. quarry cars. Stone will be loaded by an Osgood ¾-cu.yd. steam shovel and a Marion 40 crawler steam shovel with a 1½-cu.yd. dipper. The former was used for stripping overburden and for opening up the quarry. The latter was used in the construction of the 1,400-foot double-track siding which connects the plant to a branch of the L. & N. Ry. A 25-ton Browning steam locomotive crane was used in the erection of the plant and will be used for handling material to and from stock-piles. The plant, when complete, will have a capacity of about 150 tons per hour.

Construction view of Greely plant as seen from the quarry.

Receiver for Kentucky Stone Company Sought

Suit seeking appointment of a temporary receiver for the Consolidated Stone Co. of Louisville, Ky., has been filed in federal court by Edward J. Reiss, minority stockholder. The suit charges that the company is controlled by the Baltimore Trust Co., and has not been managed in an "economical and efficient manner."

The petition asked that a temporary receiver operate the stone company until such time as it is "returned to the stockholders." Allegations were made that the trust company, by virtue of holding mortgages on property of the concern, including quarries in Kentucky, has been able to exert, and has exerted, undue and detrimental influence over the conduct of its affairs. The mortgages were executed in 1929 to secure a $1,000,000 bond issue.

Victim Sues to Collect Insurance for Silicosis

Charles Baldridge, a former employee of a silica plant at Ottawa, Ill., has filed suit against the Prudential Life Insurance Co., asking $5,000 damages. Mr. Baldridge alleges that he is entitled to that settlement on account of a total-disability clause in his policy. He claims to have contracted silicosis while working at the plant and has been totally disabled as a result.

Ideas Gained on Plant Visits Aid This Owner

A new sand-and-gravel plant of relatively small capacity but completely modern and reflecting the ideas gleaned by its president, E. R. Metzger, who made a tour of the prominent operations in the Pacific northwest, is being erected on the South Umpqua River near Roseburg, Ore., by the Roseburg Sand & Gravel Co., recently formed by Mr. Metzger and W. J. Adair.

Electrically-operated drag-lines recover the raw material from a bar in the river. Marketable sizes are washed and sized for commercial use, while the large stone is crushed in a Universal jaw crusher with a Symons disk machine doing the recrushing. A special power line from the lines of the California-Oregon Power Co., has been strung to the new operation, which uses a total horsepower of 160.

New Sand Plant Nearly Ready at Ottawa, Ill.

Another new silica-sand plant will go into production near Ottawa, Ill., shortly, following the completion of the machinery installation and the opening up of its quarry by the Aetna Sand & Gravel Co., of Chicago.

Hoover to Veto Relief Bill; New Measure Due

The Senate on July 9 by a vote of 43-31 concurred with the House in approving the compromise Garner-Wagner relief bill. The House had given its approval to the measure by vote of 202 to 157.

The President's disposition of the bill is in doubt. Congress will not over-ride a veto, but will undoubtedly remain in session for enactment of a new bill if the present measure fails to obtain executive approval. Interest in providing emergency highway funds has increased during the session and it is now reasonable to expect that such will be made available. The present bill includes $120,000,000 emergency federal-aid money. A new bill will very probably include a similar amount for emergency highway work.

Feeling Badly? Try a Bottle of Sand!

Kaw River sand went into ailing stomachs as medicine some time ago, and may be doing so yet, according to the *Kansas City Citian*. John Prince, president of the Stewart Sand & Material Co., Kansas City, Mo., learned this fact when he made inquiry as to why a carload of this sand, ordered taken up at a certain section of the Kaw River was ordered by a buyer in Pennsylvania.

The buyer, according to Mr. Prince, explained he had asked a government bureau to tell him where sand of certain qualities could be obtained. The Kaw River deposit was named. The buyer paid more freight on the carload than the sand cost, which aroused Mr. Prince's curiosity, and caused him to make inquiries.

"The reply was," said Mr. Prince, "that the sand was put into 2-oz. bottles, selling at about 25 c., advertised as strongly medicinal for certain stomach ailments. We estimated the carload, which cost about $1,000 delivered, would sell for approximately $350,000 by the bottled method."

The buyer advertised a certain wealthy man still living today had kept himself capable of playing his daily round of golf by taking the marvelous remedy, "Sanded Health" (which is not the "medicine's" real name).

M. D. Hammel Manages Oregon Limestone Plant

Pulverized limestone for agricultural purposes is to be supplied farmers and fruit growers in the Willamette Valley in Oregon at an average price of $4, delivered, by the new plant of the Lime Products Mfg. Co., of Salem, Ore., now nearing completion on a deposit near Falls City.

The only previous source of agstone has been from the state plant at Gold Hill and the long haul has made the material cost the farmers from $7 to $8 per ton. The new plant, which is under the supervision of M. D. Hammel, has the whole-hearted coöperation of agriculturists in that area and production is to start shortly. Mr. Hammel was formerly president of the Hammel Construction Co., of Corvallis, Ore., which operated a quarry and crushing plant on a blue basalt deposit several years ago for supplying crushed material for road building in that section.

Recommends Lowering Alabama Agstone Rates

A recommendation has been forwarded to the Alabama Public Service Commission to the effect that present rates on agricultural limestone, with two exceptions, should be reduced to the present rate basis applicable to ordinary crushed limestone.

J. H. Alldredge, examiner for the Commission, made the recommendation on the proposal of the carriers operating in the state to revise and increase the rates on agricultural limestone, which includes ground limestone, marble and whitestone.

Mr. Alldredge reported to the Commission that he had found the carriers were not justified in their proposal except as related to mine dust and asphalt filler. The limestone in question which is excepted, is designated as that in use for concrete purposes and there seems to be no reason for discriminating between this and agricultural limestone. Exceptions to the proposed increase are to be filed during July.

Baltimore Exchange Is Opposed to Truck Haul

The Lime and Cement Exchange of Baltimore, Md., is opposed to the transportation of building materials by truck from manufacturing plants and warehouses to dealers or to jobs. In resolution form the members objected to the employment of trucking companies for such deliveries and have likewise made it plain that they do not favor such deliveries in manufacturer-owned trucks.

The Baltimore dealers claim that trucking of this nature results only in disorderly market conditions, is a menace to the construction industry and results in destructive competition for both the manufacturers and their logical distributors, the recognized builders' supply dealers.

The Exchange is hopeful that the attitude of the retailers will eliminate the trucking of materials by manufacturers or trucking companies into the Baltimore trade area.

Similar action was taken by leaders in Milwaukee recently. They were successful in their efforts.

C. C. Beam Erects New Plant at Clarksville, O.

Work has been started by C. C. Beam, Inc., well-known aggregates producer at Melvin, O., on a new sand-and-gravel plant at Clarksville, O., on an 80-acre deposit recently acquired by the concern.

The plant is to be largely of steel construction, according to Mr. Beam, the Champion Bridge Co., supplying the fabricated material.

Asks Permit to Dredge Gravel from Ohio River

The Federal Materials Co., of Cape Girardeau, Mo., has applied for permission to dredge sand and gravel from the Ohio River, from Huntington, W. Va., 208 miles upstream to a point near Wheeling, W. Va., it has been announced at the district U. S. engineers' office at Huntington.

June Building Lags Behind 1931 Period

FIRST HALF SHOWS BIG DROP

Construction contracts awarded in 37 eastern states during the first half of June showed a total valuation of $57,813,100, according to F. W. Dodge Corp. This total compares with $63,079,100 for the period from May 1 through May 14, and $158,073,800 for the comparable period of June, 1931. The contract record covering the entire month of May totaled $146,221,200 for all classes of work east of the Rocky Mountains. This was a gain of 20 per cent. over the total of $121,704,800 in April and contrasts with a total of $306,079,100 in May, 1931.

New contracts for construction in the Metropolitan area of New York during the first half of June totaled $8,479,000. This compares with $11,795,900 for the first half of May and $31,435,200 for the first half of June, 1931.

Construction undertakings in this area during all of May amounted to $17,905,900; this was an advance of 16 per cent. over the preceding month's total, produced chiefly by larger awards for public works but the May total was only about 29 per cent. as large as the volume reported in May, 1931. For the elapsed months of 1932 the contract total for all classes of work reached $81,779,100; this was 24 per cent. as large as the total for the corresponding five months of last year.

Residential awards in May showed a loss from April and were only about 13 per cent. as large as those reported in May, 1931. For the year to date this class of work showed a contraction of 80 per cent. from the like 1931 period.

Contracts let during May for nonresidential buildings likewise showed a loss from April; contrasted with May, 1931, current awards showed a loss of almost 60 per cent. For the year to date this class of work showed a contract total of $34,400,400; this was only 34 per cent. as large as the contract total shown for the corresponding five-month period of 1931.

Operating Wet-Process Plant with New Filters

The wet-process plant of the Oklahoma Portland Cement Co. at Ada, Okla., has been operating since May of this year with new filters installed on all kilns. The company, by the use of the filters, expects to reduce its fuel rate by 25 or 30 per cent. and to obtain sufficient production from the wet-process operation to enable it to dismantle the dry-process plant located adjacent to the wet plant.

Editorial

Investment in Peril

WHENEVER the conservative advocate of greater centralization in industry raises his voice in protest against the reckless multiplication of producers, the commercial adventurer, the small-scale *entrepreneur,* the clerk-become-capitalist, cries loudly for recognition of the rights of individualism and, calling heaven to witness, proclaims the impending collapse of republican institutions. To attack the misapplication of capital, to condemn the excessive growth in the forms of capital which an unrestricted duplication of productive processes necessarily entails, is to invite the stigma of radicalism and to earn the suspicious regard of the commercially ambitious but industrially superfluous. And so is sanity mistaken for imbecility.

The economics of the situation ought to be pretty plain to anyone capable of straight thinking. Thus, for example, if there are, let us say, 2,000 sand-and-gravel plants in this country when 1,500 would suffice to supply the needs of all kinds of construction, the superfluous 500 could be destroyed without in any degree diminishing the real capital value of the sand-and-gravel industry. If some great catastrophe should overtake the 500 and wipe them out of existence, although the owners of these plants might sustain a loss, that loss, expressed in money terms, would be offset by the rise in the money value of the remaining 1,500. The consumption of sand and gravel is the factor that governs the quantity of real capital engaged in sand-and-gravel production, so that if 1,500 plants are able to provide the necessary supply of sand and gravel, the value of the existing 2,000 plants is no greater than that of 1,500. That is to say, assuming that the business of the sand-and-gravel industry were equally distributed among the 2,000 plants, the real capital of the industry would be thinly spread over 2,000 plants, which could be employed only part time without glutting the market, instead of being concentrated on 1,500 plants producing, on this basis, nearer their full capacity.

If 1,500 plants can (as they did last year, for example) produce over 90 per cent. of the sand-and-gravel industry's output without utilizing, on the average, much more than 60 per cent. of their available plant capacity, it is evident that they could easily have taken care of the remaining 10 per cent. without straining their facilities. Under such circumstances there can be no economic justification whatever for the existence of the 500 plants whose combined output was but a tenth part of the industry's total. Furthermore, this 10 per cent. portion of the total, had it been distributed among the 1,500 plants instead of being spread out among 2,000, would have increased the real capital value of these 1,500 plants instead of diminishing it. In either case the value of the industry, expressed in terms of real capital, would have been the same. But, because 10 per cent. of the trade's total output was thinly spread among 500 plants, the capital investment of the 1,500 was needlessly imperiled and their profitable operation made, in many cases, an impossibility.

What has just been said with respect to the sand-and-gravel industry applies with equal force and truth—although with different figures—to every other branch of the nonmetallic-mineral industries, and in some branches the disparity between the number of producing plants and the amount of the output would be even more glaring.

Since the real capital value of an industry is determined by the consuming capacity of its customers, the capital value of each producing unit is dependent on the number of such units engaged in the industry, and the greater the number of these producing units, the lesser must be the capital value of each on the average. The advent of every newcomer, in spite of the fact that he brings fresh capital to the business, does not, under the circumstances described, add one penny to the real capital value of the industry; on the contrary, he diminishes the capital value of every established concern with which he comes in competition, makes its investment less secure, its operations more perilous, and its future more uncertain. The disappearance of every superfluous producing unit enhances the capital value of those that remain by reducing the amount and the severity of competition and by diminishing the wastefulness of duplicated effort.

This, in brief, is the economic view of the situation that confronts the nonmetallic-mineral industries in which capital investment is imperiled and profit-taking is rendered uncertain through the needless and reckless multiplication of producing factors. This industry exhibits incontrovertible evidence of the wastefulness and falsity of the theory that an industry can be indefinitely expanded and enriched by the unrestricted exercise of individual initiative and effort.

Mergers Are in Order

PERIODS of business depression and those immediately following them provide fertile soil for the merger idea, the evils of overproduction and overexpansion becoming particularly acute and conspicuous when demand falls below the expectations and capacities of producers. In our industries these evils have been especially virulent, attacking every branch of the trade and bringing about all the irritations to which an inflated business must necessarily be subjected. In this case, however, with a few exceptions, relief has not been sought in merger—although, in many ways, combination offers a rather direct route to safety when properly managed—and some satisfaction may be

derived from this fact, since mergers, rashly conceived and effected without due regard to the industrial need for consolidation, have a greater capacity for harm than for good, industrially speaking.

When Arthur Reynolds, Chicago banker, said that "it is more generally recognized that there is real economic gain in consolidations," he neglected to emphasize the difference that must be drawn between the merger of sound origin and sane program and the one conceived without regard to the welfare of the industry as a whole. Bankers are often tempted to applaud mergers without inquiring into the need or justification for them in an industrial sense; it is enough that the consolidation offers a plan for retiring bank loans concerning which the bankers have become uneasy. It is no affair of theirs, say they, if the projected merger shall render more precarious the existence of other members of the industry or add to the already burdensome difficulties of the trade. The fact that individual producers or groups of producers can not prosper in an industry that is not sound or prosperous as a whole has become too evident in the last few years to make the thoughtful advocate of mergers indifferent to their effect on the unmerged portions of the industry.

Happily, our industries have been remarkably free from the type of merger that increases rather than decreases the confusion and clutter of competition. A consolidation that seeks to keep alive the waifs of commerce through the infusion of new capital into quite exhausted enterprises must be looked upon as an obstacle to industrial progress. On the other hand, one which seeks to better conditions by a reduction of the duplication and lost motion incident to multifold productive processes marks a distinct advance and deserves the support of industry at large. Nothing more wholesome could overtake our industries than a general movement toward the elimination of their unsound producing factors. Mergers offer one safe and rapid method of accomplishing this end, provided they are conceived and carried out with regard for the best interests of the industries to which they are to belong.

The Diesel as an Economical Prime Mover in the Stone Quarry

By RAYMOND WELLEFORD
Power Shovel Engineer
Moulding-Brownell Corp.

Mines and quarries have long been recognized by Diesel-engine manufacturers as a potential market for their product. The Diesel engine's known thermal efficiency, torque, ease of operation, etc., place it in the front rank of quarry cost-reducing equipment. One reason why the Diesel engine has not received more consideration from the quarry owner is the fact that the steam-engine operator is slow to welcome this change, being under the impression that the Diesel is a complicated machine, which would lead to his dismissal in favor of a specially trained mechanic. However, the Diesel presents no difficulties that the average steam operator can not cope with after a little training.

Many quarry owners slow to modernize have found it very difficult to operate at a profit, now that the stone industry is so highly competitive owing to the slowing down of the building trades, and they are sure to emerge from the present economic unrest under conditions quite different from those prior to 1929, the peak year of building activity.

Recent figures show that there are over 270,000 hp. in steam engines, mostly obsolete, operating in stone and sand-and-gravel plants. Most of these engines will eventually be replaced by more modern equipment. The question uppermost in the mind of the prospective purchaser of Diesel and other modern equipment seems to be one of maintenance. Now that consolidations, banking interests, and other powerful influences are active in the non-metallic-mineral industries the logical solution to this problem seems to be the well-trained master mechanic, so essential in practically all other industries.

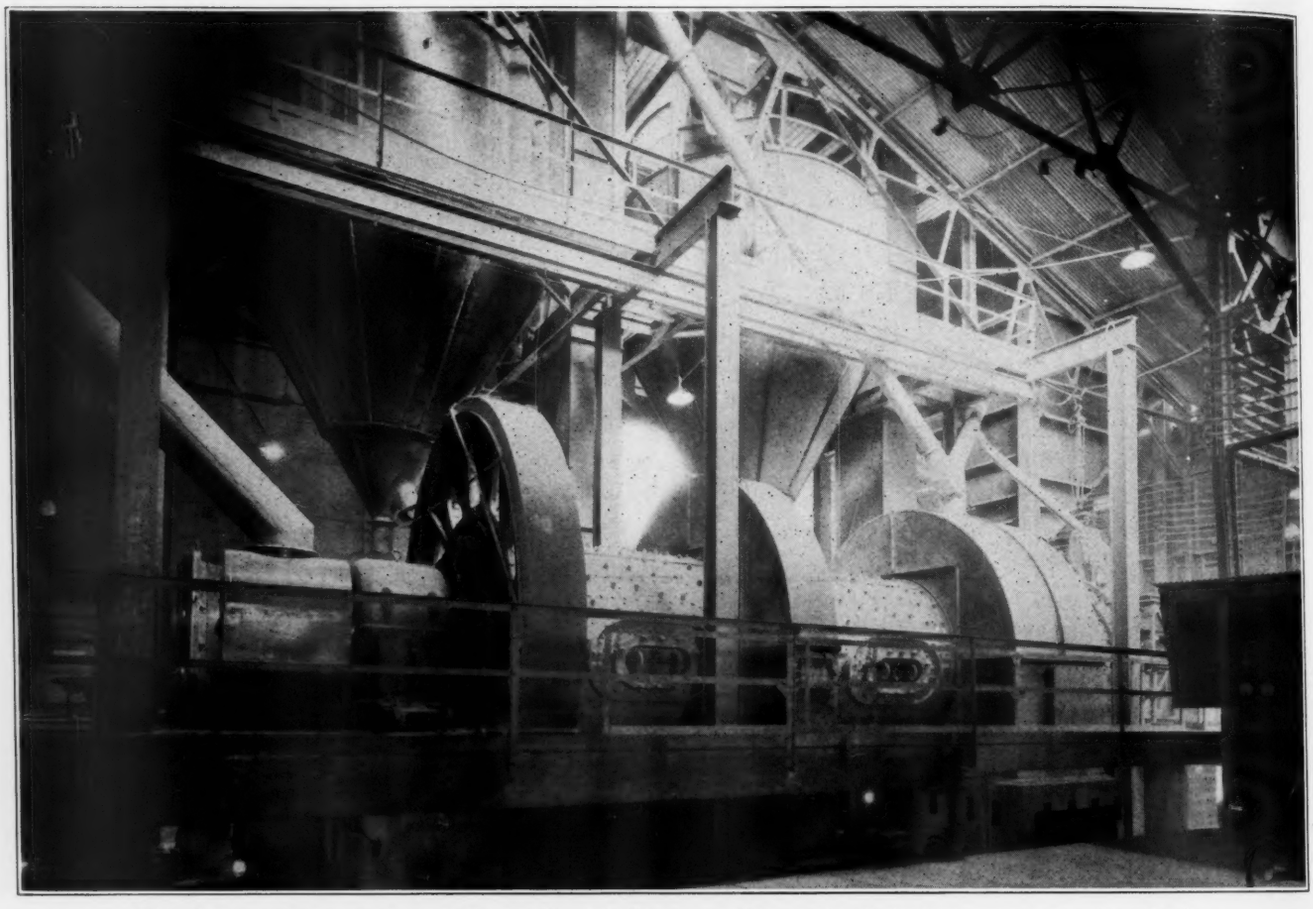
Perhaps the Diesel-electric locomotive is the most welcome improvement from the quarry owner's point of view. I shall not attempt to cover the many good points of the Diesel-electric locomotive as this has been done many times. Suffice it to say that through its use haulage costs can be cut in halves and in most cases to less than half, not to mention the lower insurance, the absence of a leaking boiler, frozen pipes, etc.

Stripping overburden, always a problem in quarry operations, is usually carried on during the winter months when equipment and men are released from other duties. When steam-shovels are used the delivery of supplies, coal, water, etc., during cold weather is difficult, as the operation is usually carried on some distance from the base. The Diesel-powered shovel has none of these objectional features, and has the added advantage of not requiring a watchman to keep steam up and everything thawed out. The gasoline-powered shovel, often will not show the same saving in cost which is so much desired in nonproductive operations.

Air-compressors, crushers, and other machines used in stone reduction can be satisfactorily operated by Diesel engines, now that the dustproof or totally-inclosed models have proved highly successful in operations where dust is present.

Large Diesel-generating plants producing power for the entire plant operation, including the electric shovel and other pit equipment, will soon become common in the stone-quarry field, judging from all indications.

Raw-Grinding and Burning Departments at Missouri Plant Are Modernized



The three-compartment raw-grinding mill with the two 16-ft. mechanical air-separators in close-circuit.

Important Changes Mark the Completion of 25 Years' Operation at Sugar Creek Mill

By W. E. TRAUFFER

THE Missouri Portland Cement Co. has always been noted for its progressiveness and its policy of keeping its plant and products at least up to if not in advance of the industry. It was as a part of this policy that the new Velo plant was built at St. Louis, Mo., in 1928 and that comprehensive improvements have been made since that time to the Red Ring plant at the same location.

In keeping with this policy an improvement program, which has brought the Sugar Creek, Mo., plant up to the same level as the company's other operations, was begun about two years ago and recently completed. The improvements involved were not confined to any one department of the plant but were so extensive that they might almost be called a reconstruction of the plant. The changes were not made to increase the capacity of the plant, but to better its efficiency and lower production costs.

The Sugar Creek cement plant originally went into operation in 1907 as a dry-process operation with four 8-ft. by 125-ft. kilns. Minor changes were made from time to time as the advancement of the industry required, but nothing of importance was done until the recent improvement program was inaugurated.

The important changes made in the plant were begun in the winter of 1930, when two 10-ft. by 17-ft. by 10-ft. by 160-ft. rotary kilns were installed to replace the four kilns already mentioned. At the same time a 9½-ft. by 8-ft. by 35-ft. Compeb mill, with two 16-ft. mechanical air-separators, was installed in the raw-grinding department. This replaced the former raw-grinding department consisting of three No. 85 Kominuters and five 5-ft. by 22-ft. tube-mills. A raw-material blending system was installed to obtain perfect control of the raw mix. An 8-in. Fuller-Kinyon pump was provided to feed from the Compeb mill to the blending system. Also, a 5-unit dust-collector was set up in the raw-grinding department. At first natural gas was used for kiln firing, but in July, 1931, a Raymond No. 15 coal-mill was installed and coal is now used.

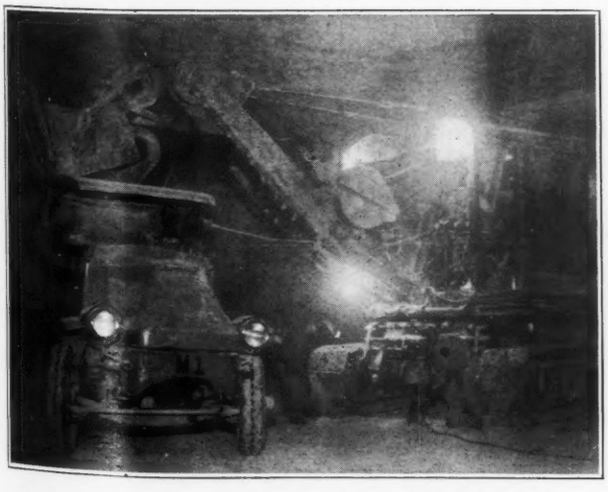
In August, 1931, two 16-ft. Raymond mechanical air-separators were installed in the finish-grinding

department. Other improvements made since that time in this department were the installation of Poidometers for proportioning clinker and gypsum and a complete dust-collecting and mill-sweeping system. Concrete kiln-dust chambers with Dietrich's suspended arches were installed, together with Polysius pug-mills for nodulizing the kiln feed and reducing stack-dust losses. Precoolers were then installed to reduce the clinker temperature. The most recent improvement was the installation of a vibrating screen which removes the fines from the primary-crusher product before it goes to the secondary crusher. Other improvements are to be made when necessary.

This improvement program also included the commercial crushed-stone plant operated by the company on the same property as the cement plant. A triple-deck Robins vibrating screen was installed and the entire loading system rebuilt to give greater loading capacity and the minimum of segregation in loading. The plant can now produce any sizes of material specified by the states, counties, cities, etc., in its territory. These improvements have just been completed.

The improvements made to the cement plant have resulted in increased efficiency and lower fuel consumption. The total horsepower requirements remain about the same, but the increased efficiency of quite a number of units has lowered the power used in those departments per barrel of cement produced. Part of this saving is due to the fact that only 4 of the 6 tube-mills are now needed for finish grinding and that many of the former conveying installations have been simplified or replaced by modern ones. Savings of this kind have been utilized for additional equipment in other departments, of which the precooler department is a good example.

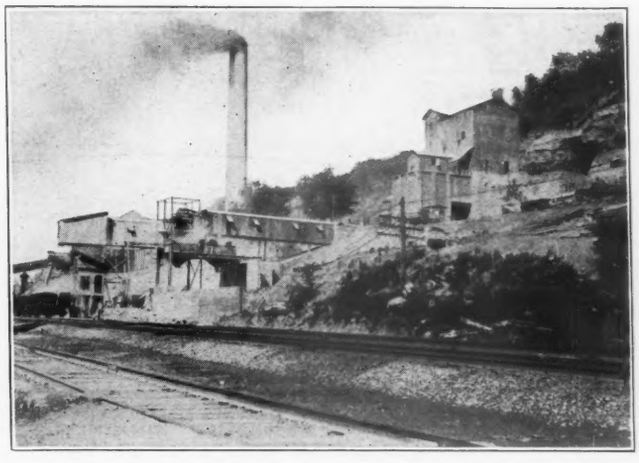
Mining Operations.—When the cement plant was built in 1907 a small quarry had been operated for some years at the top of the bluff overlooking the plant. This was deepened to the quarry-level and furnished raw material for the plant until 1910, when it was decided to abandon the quarry and open a mine. Steam and electric locomotives and cars were used up to three years ago, when they were replaced by trucks for hauling all rock to the plant.



Electric shovel in the mine loading commercial stone to truck.

The mine is of the room-and-pillar type with pillars 40-ft. square and 30-ft. rooms with a 35-ft. breast. The roof has been standing up very well under this system. In some places where the roof is of shale it has been coated with asphalt to prevent air slaking and consequent disintegration. The asphalt is sprayed on at a temperature of 360 deg. F. Operations are now being carried on as far as ¾ mi. back from the face and there is a total of 15 mi. of tunnels.

The lower 17 ft. of material in the mine is used for commercial rock and is a uniform Bethany Falls formation high in lime content. Above this is 16 ft. of Winterset limestone, which is being removed with some of the overlying Galesburg shale in the approximate proportions desired for cement rock. As all the commercial rock is removed from any heading before the cement rock is shot down, there is no possibility of any shale going into the commercial crushed stone.

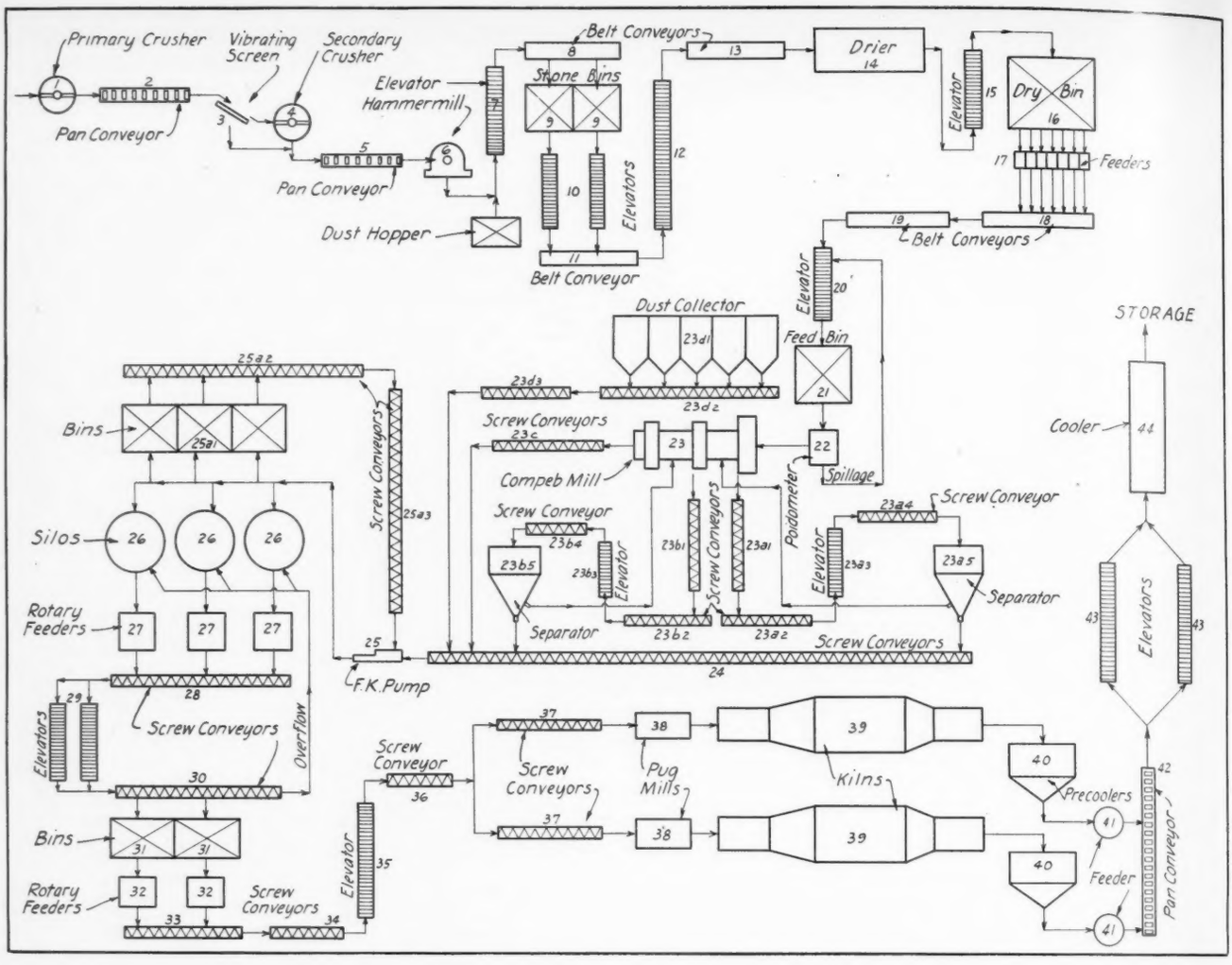


The crushed-stone plant with cement plant in background.

The commercial rock is first taken out by advancing a 9-ft. breast cut at the top with the drillers working on the bench thus formed. Then bench snake-holes are drilled from the floor-level. After the cut has been sufficiently advanced the cement rock is taken out by means of roof shots. These are started from a portable platform until a pile has been made and then they are worked from the top of the pile. The cement rock is shot out to the end of the tunnel before any loading is done.

Three electric shovels are used to load the stone. Two of these are Marion No. 32 shovels with 1¼-cu. yd. dippers and the third is a Marion No. 7 with a ¾-cu. yd. dipper. Each of these shovels forms a separate unit in the mining of the rock, having its own crew of drillers, blasters, etc. Each crew has its own foreman with a superintendent and assistant superintendent over all operations.

Seven heavy-duty trucks are used to haul the stone to the plants. There are also 3 light trucks, which are used for various purposes about the plants and mine. All the main haulage-ways in the mine are well lighted and each shovel has its own battery of lights. To settle the dust made by the



Flow-sheet showing main operations up to clinker storage at the Sugar Creek plant.

trucks the haulage-ways are sprinkled regularly. All three shovels are used during the daytime hauling commercial rock to the stone plant. At night one shovel loads mixed rock, which is hauled directly to the cement-plant crushing unit.

No fans are required to ventilate the mine as the natural draft is sufficient. Government tests have shown no gases of any kind. Two vertical air-shafts furnish the ventilation. One of these is located ¼ mi. and the other ⅓ mi. back from the face. There is very little seepage from the mine and this is collected in a sump from which it is handled by a small pump.

A substation in the mine receives power at 2,300 v. and reduces it to 440 v. for the shovels. A machine-shop is also maintained in the mine, where most of the mine repair work is done. This shop has an Ingersoll-Rand drill-sharpener, a drill-press, forge, lathe, etc. Air for the drills is brought in from the plant by an 8-in. line to air-receivers from which smaller lines lead to the drills. Explosives are stored in two magazines about a mile from the plant. Each of the three operating units in the mine has a small magazine in which a day's supply of explosive is stored.

The mine and crushing-plant office is located near the mouth of the main haulage tunnel. Here is kept a complete map of the mine with colored pins marking the shovel, drill, and blast locations, as well as the shots ready for the shovel. This map is kept up to date at all times. A Fairbanks truck-scale at this office is used for weighing cement-plant stone for tests and for a daily check on output.

Crushed-Stone-Plant Operations.—The crushed-stone plant was put into operation in January, 1926, and has operated continuously without any important changes until recently. Changed specifications for stone made it necessary to improve the existing loading facilities to prevent segregation and it was decided to improve the truck-loading facilities at the same time. These changes were made without interference to plant operation and were only recently completed. In harmony with the original plant, all the new construction is concrete and steel and only equipment of the latest approved type is used.

Originally stone was hauled from the mine to the plant by locomotives and cars. About three years ago this method was abandoned both for the crushed-stone and cement plants and motor trucks have been used successfully since that time. The mining and haulage methods have already been completely described.

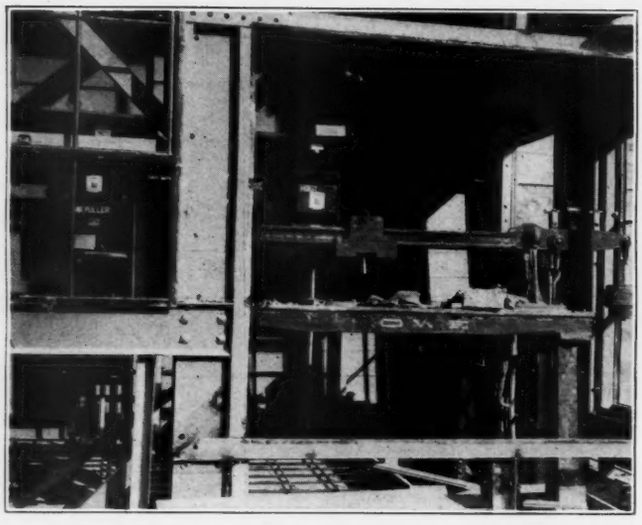
The trucks now unload directly into an Allis-Chalmers McCully No. 10 gyratory primary

TABULAR ANALYSIS OF THE OPERATION AND EQUIPMENT OF THE MISSOURI PORTLAND CEMENT CO. PLANT AT SUGAR CREEK, MO.

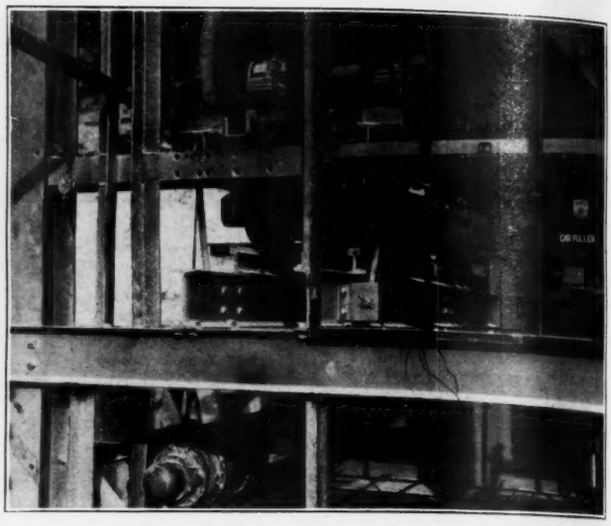
Raw-Material Crushing to Clinker Storage Only

(Key numbers refer to corresponding numbers on accompanying flow-sheet)

Operation	Key	Equipment	Make	Model No., Size, Capacity or Type	Power Source	Power Transmission
Primary crushing	1	Primary crusher	Allis-Chalmers	No. 10 McCully	100-hp. G. E. motor	Belt
	2	Pan-conveyor	Allis-Chalmers	36-in., 43-ft. centers	Belt-driven from primary-crusher shaft	
	3	Scalping screen (Oversize to 4) (Throughs to 5)	Allis-Chalmers	5-ft. by 10-ft., single-deck	10-hp. motor	Texrope
Secondary crushing	4	Secondary crusher	Austin	No. 7½ gyratory	75-hp. G. E. motor	Belt
Final crushing	5	Pan-conveyor	Chain-Belt	Rex 24-in.		
	6	Hammer-mill	Williams	Jumbo Type W	200-hp. G. E. motor	Link-Belt silent-chain
	7	Elevator	Chain-Belt	Rex 24-in.		
	8	Belt-conveyor		24-in.		
Raw-material storage and preliminary blending	9	Storage-bins (2)		2,000- and 4,000-ton		
	10	Pan-feeders (2)				
	11	Belt-conveyor		30-in.		
	12	Elevator	Chain-Belt	Rex 16-in.		
	13	Belt-conveyor		30-in.		
Drying, mixing and intermediate blending	14	Rotary drier		8-ft. by 125-ft.	75-hp. G. E. motor	Link-Belt silent-chain and-gear
	15	Bucket-elevator	Chain-Belt	Rex 16-in.	20-hp. G. E. motor	Westinghouse Nuttal speed-reducer
	16	Storage-bin		1,500-ton		
	17	Feeders (7)		Reciprocating		
	18	Belt-conveyor		30-in.		
	19	Belt-conveyor		30-in.	3-hp. G. E. motor	Westinghouse Nuttal speed-reducer
	20	Bucket-elevator		22-in. center discharge	15-hp. G. E. motor	Westinghouse Nuttal speed-reducer
Grinding	21	Feed-bin		150-ton		
	22	Poidometer (Spillage back to 20)	Schaffer	20-in. by 4-ft. 6-in.	1 to 3-hp. Westinghouse variable-speed d.-c. motor	
	23	Raw-grinding mill (1st-compartment discharge to $23a_1$) (2d-compartment discharge to $23b_1$) (3d-compartment discharge to 23c)	Allis-Chalmers	Compeb, 9-ft. by 8½-ft. by 35-ft.	900-hp. G. E. supersynchronous motor	
	23c	Screw-conveyor (To 24)		16-in.		
Primary air-separation		(From 23, 1st compart.)				
	$23a_1$	Screw-conveyor		16-in.	10-hp. G. E. motor	DeLaval speed-reducer
	$23a_2$	Screw-conveyor		16-in. right- and left-hand	12½-hp. G. E. motor	James speed-reducer
	$23a_3$	Bucket-elevator		22-in.	20-hp. G. E. motor	Westinghouse Nuttal speed-reducer
	$23a_4$	Screw-conveyor		16-in.	Driven from headshaft of elevator $23a_3$	
	$23a_5$	Air-separator (Fines to 24) (Coarse to 2d compartment of 23)	Raymond	16-ft. mechanical	50-hp. G. E. motor	Texrope
Grinding and secondary air-separation		(From 23, 2d compart.)				
	$23b_1$	Screw-conveyor		16-in.	10-hp. G. E. motor	Delaval speed-reducer
	$23b_2$	Screw-conveyor		16-in. right- and left-hand	Same as $23a_2$	
	$23b_3$	Bucket-elevator		22-in.	20-hp. G. E. motor	Westinghouse Nuttal speed-reducer
	$23b_4$	Screw-conveyor		16-in.	Drive from headshaft of elevator $23b_3$	
	$23b_5$	Air-separator (Fines to 24) (Coarse to 3d compartment of 23)	Raymond	16-ft. mechanical	50-hp. G. E. motor	Texrope
Dust-collection and return	$23d_1$	Dust-collector	Allis-Chalmers	5-compartment, Style C	3-hp. A.-C. motor	
	$23d_2$	Screw-conveyor		9-in.	3-hp. G. E. motor	Westinghouse Nuttal speed-reducer
	$23d_3$	Screw-conveyor (To 24)		9-in.	Driven from $23d_2$ through	Link-Belt right-angle gear-box
Pulverized-material handling		(From $23a_5$, $23b_5$, 23c, and $23d_3$)				
	24	Screw-conveyor		16-in.	12½-hp. motor	James speed-reducer
	25	Pump	Fuller-Kinyon	8-in.	75-hp. G. E. motor	Direct
Reserve storage	$25a_1$	Bins (3)		350-ton each		
	$25a_2$	Screw-conveyor		12-in.	15-hp. G. E. motor	Link-Belt silent-chain
	$25a_3$	Screw-conveyor (Back to 25)		12-in.	12½-hp. G. E. motor	Westinghouse Nuttal speed-reducer
Final blending	26	Blending silos (3)		450-ton each		
	27	Feeders (3)	Fuller Co.	Rotary	All driven from lineshaft by 15-hp. G. E. motor	Texrope and cone pulleys
	28	Screw-conveyor		20-in.	30-hp. G. E. motor	Westinghouse Nuttal reducer
	29	Bucket-elevators (2)	Chain-Belt	Rex 24-in., continuous	12½-hp. G. E. motors	Link-Belt silent-chain and gear
	30	Screw-conveyor (Overflow back to 26)		16-in.	15-hp. G. E. motor	Falk speed-reducer
Storage and nodulizing	31	Bins (2)				
	32	Feeders (2)	Fuller Co.	Rotary	3-hp. G. E. motors	Link-Belt silent-chain, cone pulleys and chain
	33	Screw-conveyor		16-in.	5-hp. motor	Falk speed-reducer
	34	Screw-conveyor		16-in.		
	35	Bucket-elevator	Chain-Belt	Rex 16-in., continuous	12½-hp. G. E. motor	Falk speed-reducer
	36	Screw-conveyor		20-in.	5-hp. G. E. motor	Falk speed-reducer
	37	Screw-conveyors (2)		16-in. half-pitch	5-hp. Westinghouse d.-c. variable-speed motors	Link-Belt worm reducer
	38	Pug-mills (2)	Polysius	36-in. by 15-ft.	30-hp. G. E. motor	Polysius speed-reducer
Burning and cooling	39	Kilns (2)	A. G. Reeves	10-ft. by 17-ft. by 160-ft.	200-hp. Westinghouse variable-speed motors	A. G. Reeves lubricated gear-boxes
	40	Precoolers (2)				
	41	Feeders (2)		5-ft., table	5-hp. G. E. variable-speed motors	Falk speed-reducers
	42	Pan-conveyor	Stephens-Adamson	30-in. by 80-ft.	10-hp. G. E. motor	Falk speed- educer
	43	Bucket-elevators (2)		18-in., continuous	7½-hp. G. E. motors	Falk speed-reducers
	44	Cooler		8-ft. by 125-ft., rotary	75-hp. G. E. motor	Link-Belt silent-chain



Track scale and electric control-board in the crushed-stone loading building.

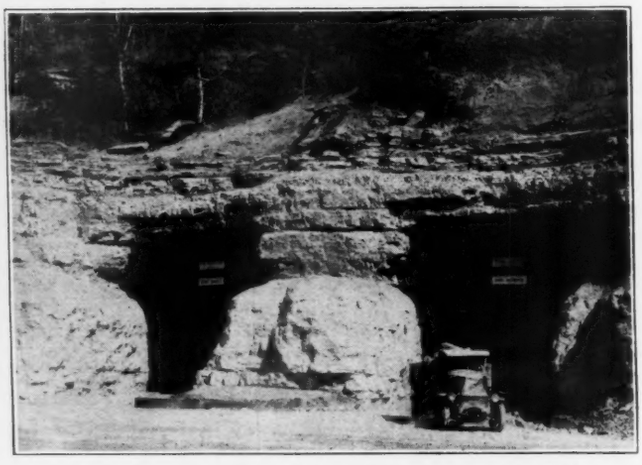


Hoist and pitman which operate loading spout at commercial-stone plant.

crusher, which discharges to an Allis-Chalmers 30-in. continuous pan-elevator which carries the rock to a 72-in. by 24-ft. rotary screen. This has an 8-ft. long and 8-ft. 4-in.-diameter dust-jacket. Rejects drop to a 24-in. belt-conveyor which feeds a 10-in. McCully reduction crusher. This reduces the stone to the same size as the largest opening on the scalping screen, and discharges back to the elevator leading to the screen.

The material under 1½ in. in size from the scalping screen is chuted to a 5-ft. by 12-ft. Robins triple-deck vibrating screen, which produces three sizes of stone that are discharged through chutes to storage-bins. The dust from the bottom deck of this screen and from the dust-jacket of the scalping screen goes to a fourth bin, from which it can be loaded through a chute to trucks for use in the cement plant.

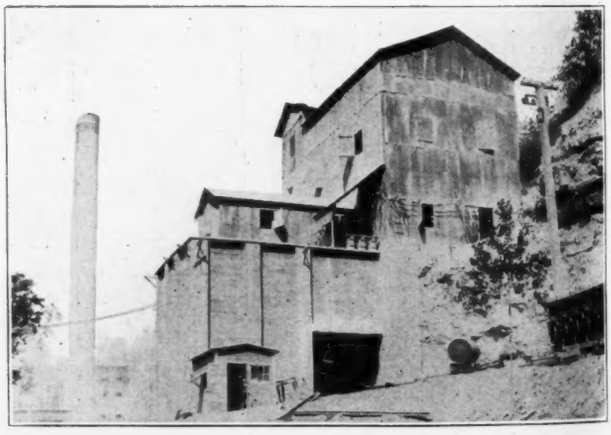
The primary crusher is belt-driven by a 125-hp. G. E. motor and the secondary crusher by a 100-hp. motor of the same make. The pan-elevator is driven through a speed-reducer and gear by a 60-hp. G. E. motor and the screen is driven in the same manner by a 30-hp. G. E. motor. The belt-conveyor is driven by a 5-hp. motor through a speed-reducer and the vibrating screen by a 10-hp. motor through Texrope.



Truck-load of commercial stone coming out of mine.

The 1½-in. to 2¼-in. material from the scalping screen is fed to a 24-in. belt-conveyor which is arranged so that any of or all this material can be discharged to a rejection belt-conveyor which feeds a Williams Type W Jumbo hammer-mill for further reduction. This hammer-mill can also be supplied by trucks from storage if desired. The purpose of this unit is to give more ¼-in. stone when this size is in demand. The hammer-mill also feeds the primary elevator, and is driven by a 200-hp. direct-connected motor.

The main 24-in. belt is driven by a 15-hp. motor through a speed-reducer. It can also discharge any



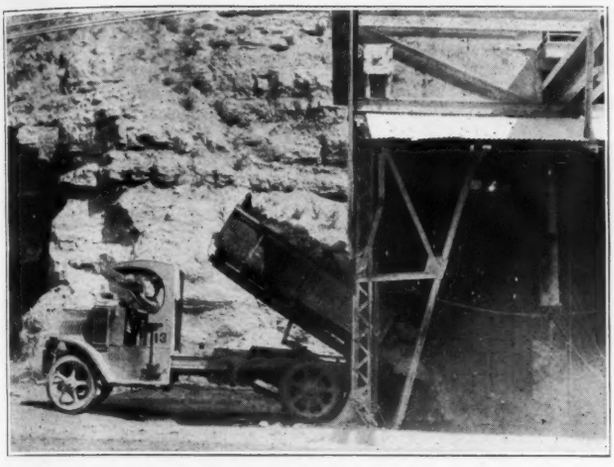
The commercial crushed-stone plant with cement plant in background.

of or all this material to a storage belt-conveyor supported by a timber trestle and having a Link-Belt traveling tripper. This discharges to stock-piles in a worked-out mine opening, which is alongside the plant and has a capacity of about 8,000 tons. This underground storage keeps the material dry and uncontaminated until it is ready for shipment.

A 30-in. belt-conveyor operating on 730-ft. centers runs in a tunnel under the stock-piles and bins and reclaims any size or mixture of sizes from the stock-piles and bins as desired. This conveyor runs on a steel-frame gallery, where it discharges to a 4-ft. by 8-ft. Niagara double-deck vibrating screen which removes any dust caused by handling and

drops it in a 40-ton steel bin under the screen. The coarse material from the screen is discharged on a 30-in. reversible belt-conveyor which can discharge to a second 40-ton steel truck-loading bin alongside the dust-bin. Trucks haul the material from the dust-bin to the cement plant and from the stone-bin to the cement plant or for local deliveries.

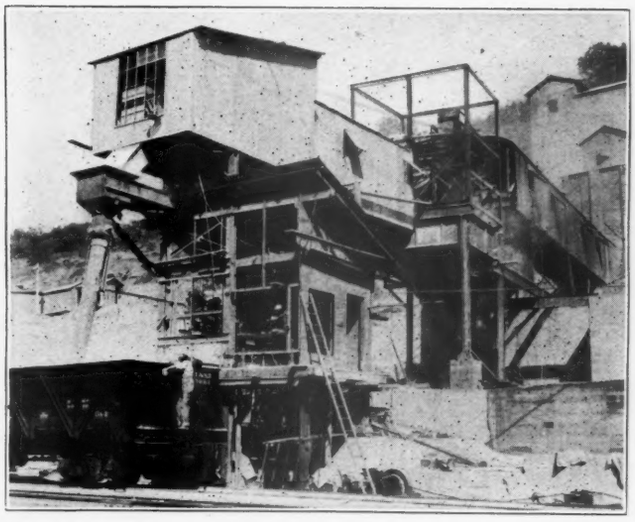
Ordinarily the belt-conveyor discharges to a steel car-loading hopper in the new loading building, from which the material is taken through a telescopic loading spout into cars. The spout is raised and lowered by a Shepard reversible hoist fitted with an automatic brake and is moved by a pitman from side to side of the car while loading to prevent segregation. Further to insure against segregation



Truck discharging to primary crusher at crushed-stone plant.

the car being loaded is moved back and forth under the spout so that the stone is loaded in three layers. This is accomplished with a single-drum hoist using both ends of the cable and sheaves. This hoist is driven through a speed-reducer by a 30-hp. variable-speed alternating-current motor fitted with a reversible controller. The cars are "spotted" at the loading hopper from a storage-track by another hoist driven by a 15-hp. motor through a silent-chain drive. A Howe automatic recording track-scale weighs the cars as they are loaded and punches tickets for each load.

The tunnel reclaiming conveyor is driven by a 25-hp. motor through a speed-reducer and the loading conveyor by a 7½-hp. motor through a speed-reducer. The Niagara screen is Texrope-driven by a 5-hp. motor and the pitman by a 2-hp. motor

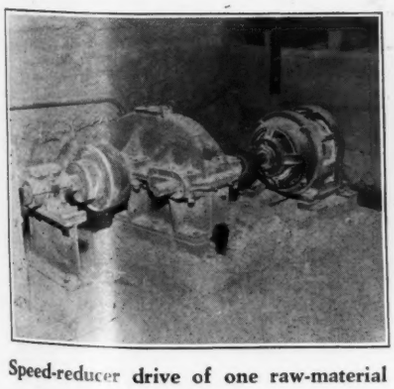


Loading crushed stone to car. Note swinging spout which eliminates segregation.

through a speed-reducer. An Ohio locomotive-crane can load from cars to 6 steel truck-loading bins, which are used when there is a large demand for truck shipments exceeding the capacity of the small truck-loading bin. A truck-scale is used to weigh these shipments. Most of the commercial stone produced is sold for concrete construction and railroad ballast.

Cement-Plant Crushing and Grinding.—The cement rock, consisting of a mixture of limestone and shale, is hauled during the night shift to the cement-plant crushing unit. The trucks dump directly into a No. 10 Allis-Chalmers McCully gyratory crusher for primary reduction. This crusher discharges to a 36-in. inclined pan-conveyor, which operates on 43-ft. centers and feeds a 5-ft. by 10-ft. Allis-Chalmers single-deck vibrating screen provided with 3-in. openings. The oversize drops to a No. 7½ Austin gyratory crusher. The material passing through the screen, together with the secondary-crusher product, is fed to a 24-in. inclined pan-conveyor. This in turn feeds a Williams Type W Jumbo hammer-mill for further reduction. The Williams machine discharges to a steel-inclosed 24-in. continuous bucket-elevator. The dust from the commercial-stone plant is dumped from trucks into a steel hopper, from which it can be fed through a sliding gate to the same elevator.

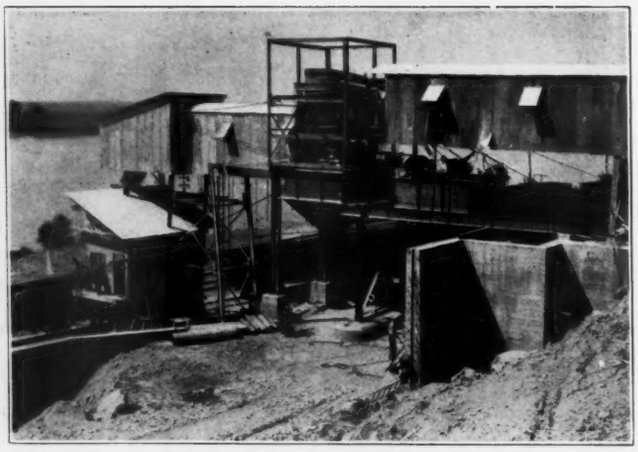
The bucket-elevator discharges to a 24-in. horizontal belt-conveyor which feeds by means of an



Speed-reducer drive of one raw-material screw-conveyor.

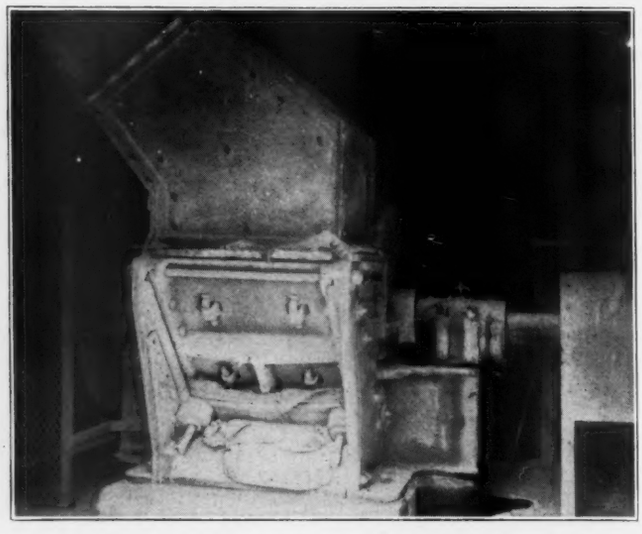
Electric welding inlet-scoop plates for the tube-mills.

Speed-reducer drive of main screw-conveyor from raw-mill.



Car-loading building, truck-loading bins and scalping screen at commercial-stone plant.

automatic tripper into either of two compartments of a 3-compartment stone-storage bin. These compartments are used for high, low and dry stone and have capacities of 2,000, 4,000 and 1,500 tons, respectively. Pan-feeders reclaim from the high and low bins in any desired proportion for the rough mix and discharge to a 30-in. belt-conveyor, which feeds a 16-in. steel-inclosed bucket-elevator. This discharges to another 30-in. belt-conveyor, which unloads through a feed-spout into the 8-ft. by 125-ft. rotary drier. The drier was made from one of the old rotary kilns and is unlined. It is fired by

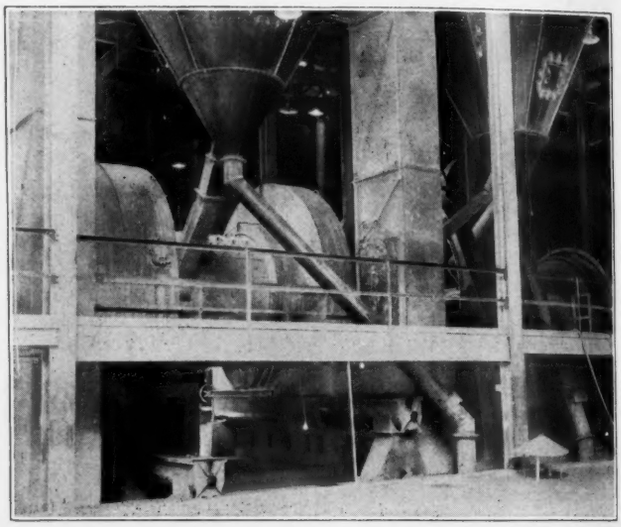


Hammer-mill used as tertiary crusher in cement-plant.

natural gas with a burner of the company's own design. Air is furnished by a Buffalo blower fan.

The drier discharges to a steel-and-concrete-inclosed bucket-elevator which feeds the material into the 1,500-ton dry-rock storage-bin previously mentioned. The dry stone is reclaimed from this bin by pan-feeders which discharge to the first of a series of two 30-in. belt-conveyors. These feed a 22-in. high-speed chain-bucket-elevator provided with a centrifugal discharge. This is inclosed in steel and concrete and discharges into the 150-ton steel Compeb-mill feed-bin. A single unit 20-in. by 4-ft. 6-in. Schaffer Poidometer feeds from the bin to the mill. It is inclosed in a steel housing which has a hopper bottom and in which any spillage is collected to be returned by a screw-conveyor to the elevator feeding the mill-feed bin.

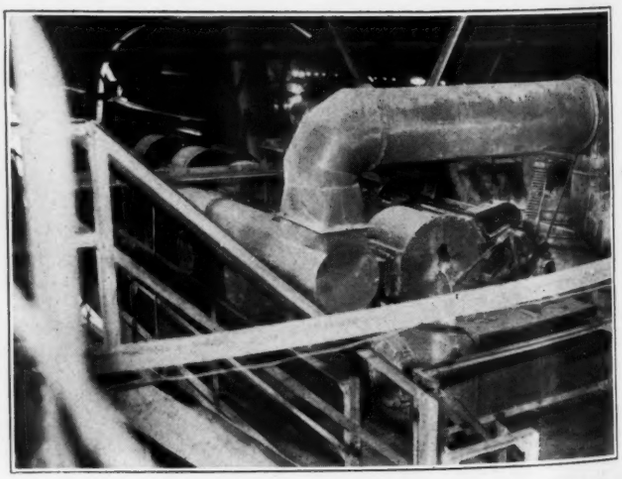
The Allis-Chalmers Compeb mill is a 9½-ft. by 8-ft. by 35-ft. 3-compartment dry-grinding unit and operates with two 16-ft. Raymond air-separators. The first compartment of the mill has Allis-Chalmers forged-steel grinding balls ranging from 2½ to 4-in. in diameter; the second and third compartments have 1¼-in. and ⅞-in. Concavex respectively. The fine material passing through the peripheral screen around the first compartment drops to the bottom of the hood inclosing this screen. A 16-in. screw-conveyor feeds to one flight of a 16-in.



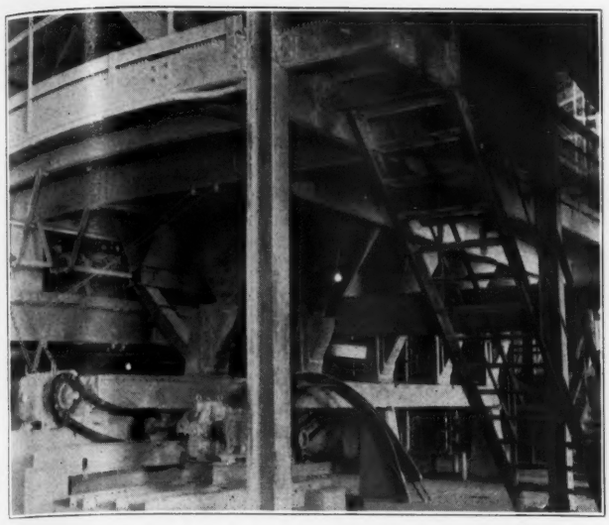
Raw-grinding mill with separators, drive motor, elevators and screw-conveyors.

main right-and-left-hand collecting screw which handles all except the finished material coming from the mill. The material from the first compartment is elevated by a 22-in. steel-and-concrete-inclosed bucket-elevator to a short 16-in. screw-conveyor which feeds the first 16-ft. Raymond separator.

The coarse material from this separator is chuted back to the scoop housing of the second compartment of the mill and the fines are chuted to the mill-stream screw-conveyor. The discharge from



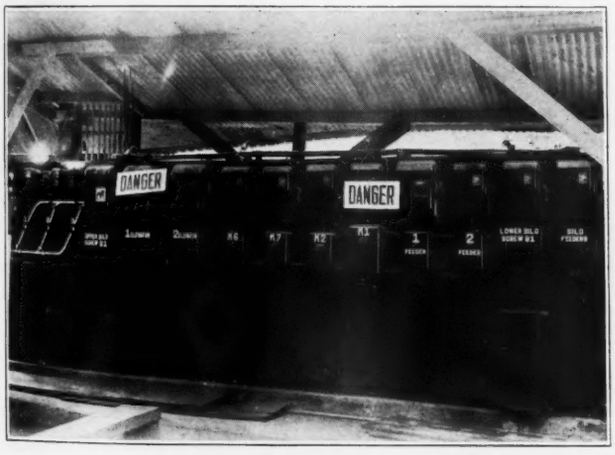
The top of the dust-collector in the raw-mill building.



Screw-conveyor reclaiming dust from raw-mill dust-collector.

the second compartment of the mill goes in the same manner to a screw-conveyor feeding another flight of the main screw. Another elevator and screw-conveyor feed the second 16-ft. separator. The coarse material goes to the third mill compartment and the fine to the mill-stream screw. The material from the third compartment is fed by a 16-in. screw-conveyor to the 16-in. mill-stream screw.

The Compeb mill is air-swept by a 5-compart-



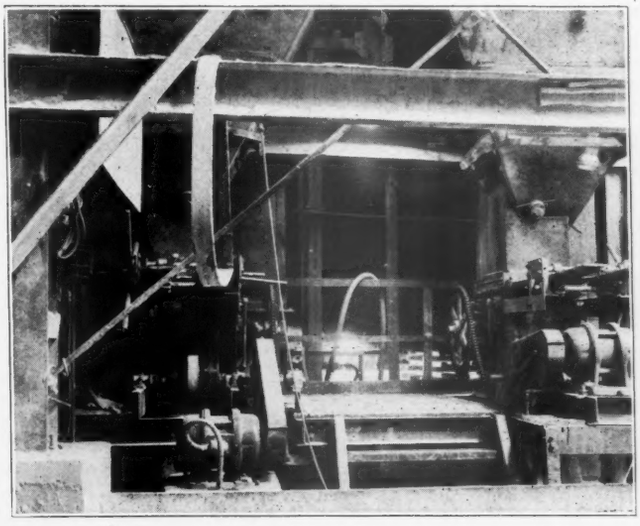
Control-board of raw-blending system.

ment Allis-Chalmers Style C dust-collector, which is also connected to all elevators, screw-conveyors, scoop housings and bins in the raw-grinding department. A fan, driven by a 30-hp. Allis-Chalmers motor through Texrope, furnishes the suction. The collected dust is taken by a series of two 9-in. screw-conveyors to the mill-stream screw. The finished raw material runs from 90 to 93 per cent. through 200-mesh. The mill is arranged so that either of or both the separators can be by-passed if desired. The capacity of the Compeb mill is about 60 tons per hr. at a fineness of 90 to 93 per cent. through 200-mesh.

Blending and Nodulizing.—The mill-stream screw feeds to an 8-in. Fuller-Kinyon pump which is the first unit of the raw-material-blending system. The pump sends the material either to three circular concrete blending silos, 25-ft. in diameter and 35-ft. high, or to a rectangular concrete storage used as auxiliary storage. The former's total capacity is 1,350 tons and that of the latter is 1,050 tons. The storage material can be reclaimed by means of a series of two 12-in. screw-conveyors leading back to the 8-in. Fuller-Kinyon pump for redistribution to the silos.

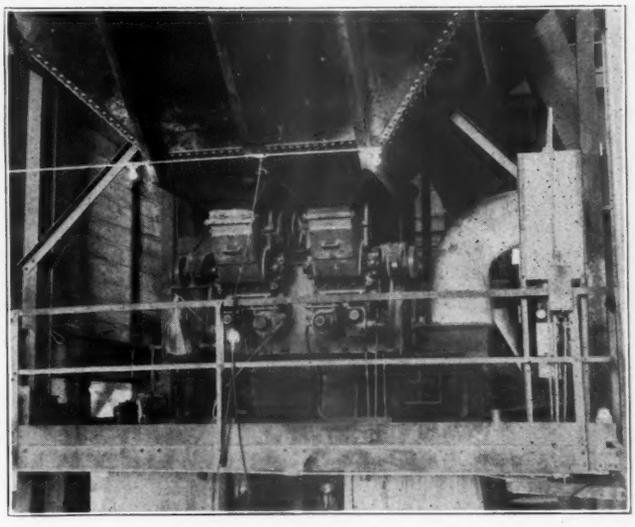
The mill stream from the pump discharges through Fuller-Kinyon electro-pneumatic valves to these silcs. The valves are automatically controlled by time relays from a control-board which is of the company's own design and controls the final blending of the raw material.

Each of the 3 blending silos discharges through 5 pipes to one of three Fuller rotary feeders. A 20-in. screw-conveyor discharges to one of two 24-



Rotary feeders and elevators of raw-blending system.

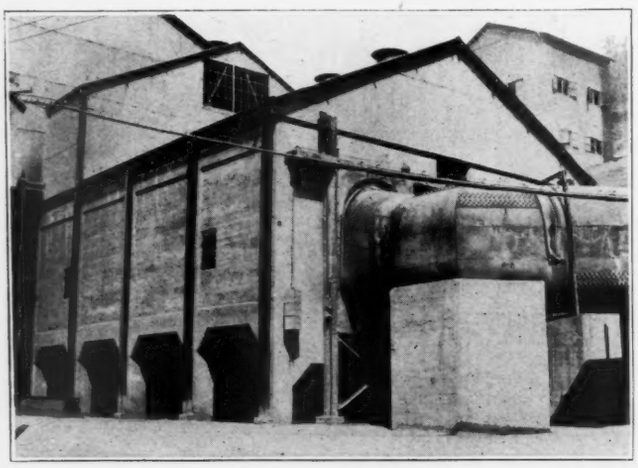
in. continuous steel-and-concrete-inclosed bucket-elevators, which feed through a 16-in. screw-conveyor box into two 200-ton rectangular steel storage-bins. This box keeps the bins full at all times and feeds the overflow through chutes to any of the silos. These chutes have Fuller-Kinyon valves which are operated from the control-board.



The coal-grinding mill alongside firing end of kiln.

The two bins have hopper bottoms. Fuller Co. feeders discharge to a series of two 16-in. screw-conveyors leading to a 16-in. continuous-bucket-elevator. This feeds to a 20-in. screw-conveyor which in turn supplies two 16-in. half-pitch screw-feeders which are inclosed in pipes instead of the usual troughs. These feed two 36-in. by 15-ft. Polysius pug-mills where the addition of about 8 per cent. of water nodulizes the material sufficiently to reduce stack-dust losses considerably. The pug-mills discharge through special alloy-steel pipes to the kilns.

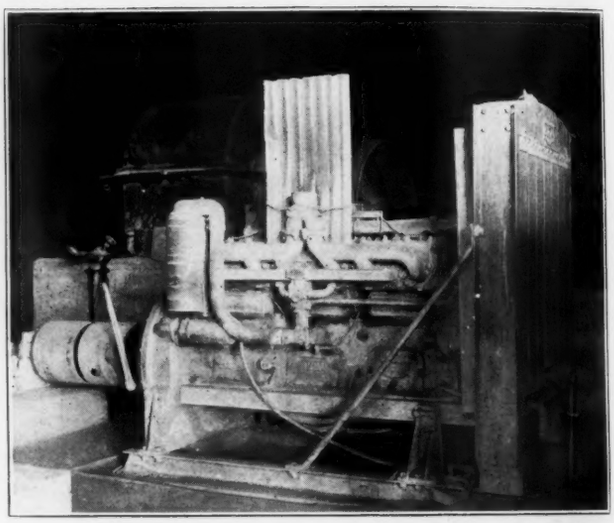
The method of nodulizing is similar to that used in a number of European plants and has been found advantageous, especially in connection with en-



The concrete kiln-dust chamber with connection to stacks at right.

larged-zone kilns. A kiln of that type must always be operated with a compromise between desired speed for the small-diameter zones and the enlarged zones. In other words, in a dry kiln with a considerably-enlarged calcining zone the material should turn over in the calcining zone as well as in the drying or clinkering zone. Since the desired circumferential speed of the much-enlarged calcining zone of such a kiln is too slow for the smaller zones, the charge in those zones will slide, not being in all parts properly exposed to the gases. The tendency to slide will be decreased if the structure of the material will be changed from powder form to nodules and this, together with the chance of cutting down the stack dust, is the advantage of nodulized dry-kiln feed.

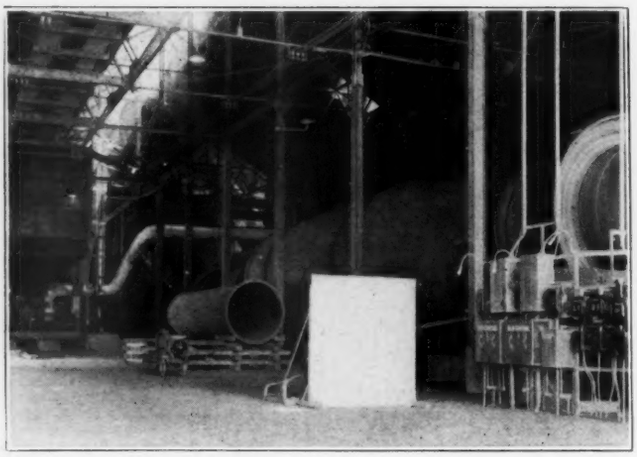
Kilns, Precoolers and Coolers.—The two A. G. Reeves kilns are of a special design and have greatly-enlarged calcining zones. They are 160 ft. long and 10 ft. and 17 ft. in exterior diameter. The preheating and drying zone of each kiln is 10 ft. in diameter and 63 ft. long. A taper 16 ft. long brings the diameter up to 17 ft. for the calcining zone which is 40 ft. long. A 3-ft. taper brings it back to 10 ft. diameter for the remaining 38 ft. of kiln length. The tapered sections are reinforced by I-beams. Each kiln has three riding tires riveted to its shell and riding on single rollers. Each kiln is driven through a Reeves lubricated gear-box belt-driven by a variable-speed motor. Actually only 75 hp. is required to operate each kiln. Each kiln has an auxiliary drive to be used in case of power failure. A Medart jaw-clutch pulley connects each kiln drive to a belt driven by a Buda 135-hp. gaso-



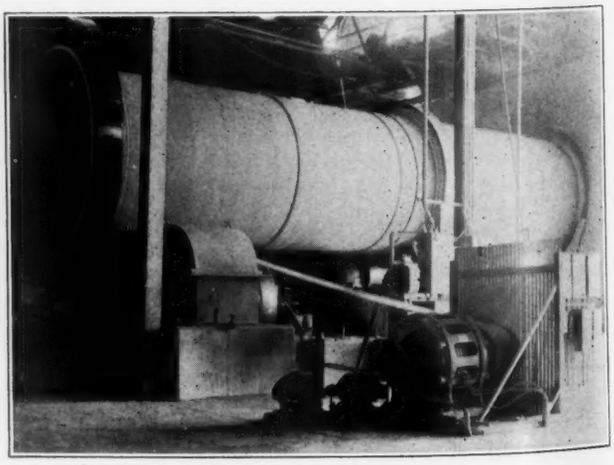
Gasoline engine used as an auxiliary kiln drive.

line engine. The daily capacity of both kilns is 3,100 to 3,500 bbl.

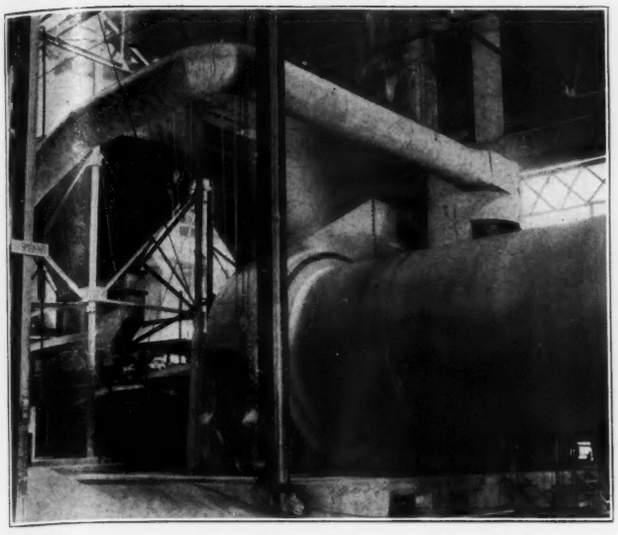
The kilns discharge through alloy-steel grates in the kiln hoods to two precoolers designed by Richard Uhlig, general superintendent of the company. These are compact in design and each has a circular

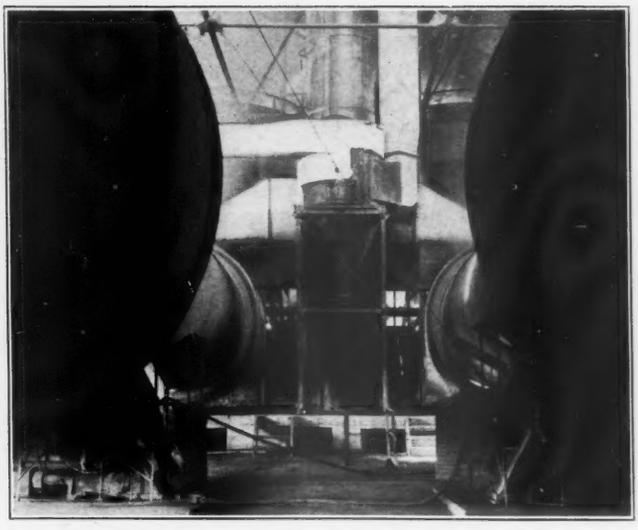


A view in the kiln building.



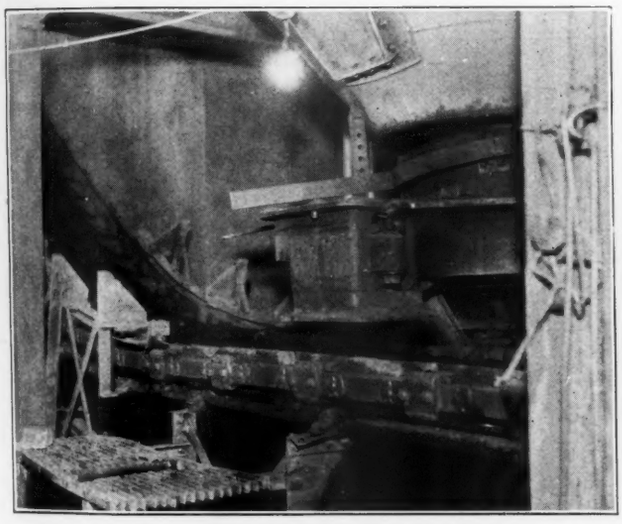
Drive and feed end of one of kilns.





Two views looking toward the firing ends of the kilns, showing precooler, stack, etc.

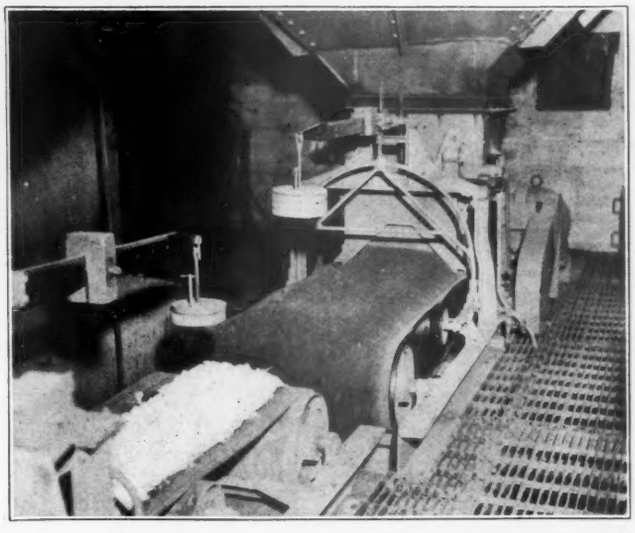
section and a conical bottom. They are lined at the sides and bottoms with Carborundum brick. Around the entire shell there is an air-jacket into which air is forced by a Buffalo fan. Air goes from this jacket through four alloy-steel oval pipes to a conical bowl in the center of the precooler. Rows of concentric tapered rings are so arranged that the



One of clinker precoolers discharging to pan-conveyor.

air has access to the clinker but the clinker can not enter the air chamber. The precooler is kept full at all times so that the bowl is always completely covered to give the most efficient cooling. The clinker leaves the kilns at temperatures ranging from 1,800 to 2,000 deg. F. and leaves the precooler at temperatures ranging from 285 to 350 deg., which makes it possible to handle the clinker at these temperatures with any standard pan-conveyor. Before installing these special precoolers the hot clinker was carried by a drag-chain to one cooler located parallel to both kilns. This installation was not satisfactory and the cooling effect was insufficient. The change of this condition was quite a problem because the discharge end of the kiln was surrounded by the coal-mill, raw-grinding department, and blending station. There was practically only one way out and that was going into the ground. This led to the design of the above-described shaft cooler. Part of the waste air is used for preheating combustion air, part for coal drying in the Raymond coal-mill, and the remainder is wasted.

Each precooler has a table-feeder which discharges to a 30-in. by 80-ft. Stephens-Adamson pan-conveyor operating on white-iron riding shoes instead of rollers. This conveyor is horizontal under the precoolers and then inclines to discharge to one of two duplicate 18-in. continuous-bucket-elevators. One of these is kept in reserve for an emergency. The elevator in use discharges through a white-iron-lined chute to an 8-ft. by 133-ft. rotary cooler.

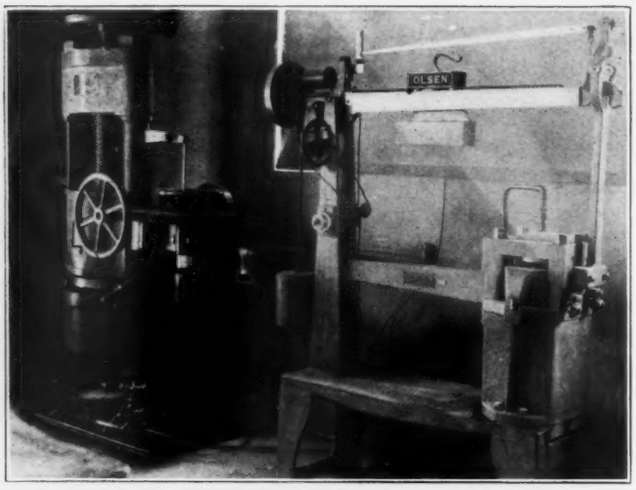


Proportioning scales feeding clinker and gypsum to the finish-grinding mills.

This is also an old kiln which has been rebuilt and had its lining removed. A 3-ft.-diameter steel core has been installed in this cooler for a distance of 42 ft. Four steel webs connecting this core to the shell form four cells, each of which is equipped with baffles and lifters. The remainder of the cooler is also equipped with lifters. The temperature of the cooled clinker varies between 120 and 180 deg. F. and under ordinary operating conditions the clinker can be held in the hand without discomfort.

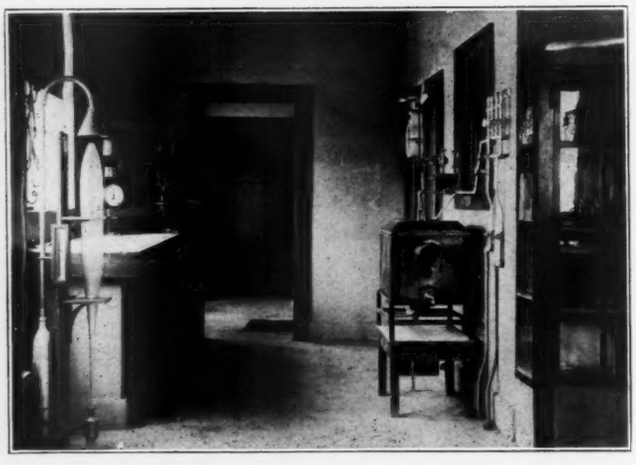
The accompanying flow-sheet does not show the disposition of the kiln dust, which is deposited in two dust-chambers from which it is reclaimed by two screw-conveyors which discharge to a single screw-conveyor feeding the bucket-elevators (29 in the diagram) in the final-blending stage. Neither does it show an overflow feed-box, which precedes the feeders supplying the pug-mills, and which discharges into the two screw-conveyors just mentioned. Nor does it show the coal-handling and grinding operations to be described later.

Clinker Storage and Grinding.—The clinker drops from the cooler to a storage-pile at the mouth

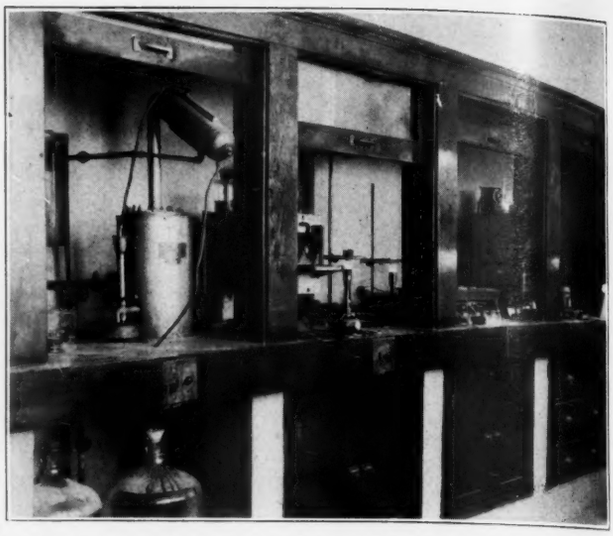


Compression-testing machine in the physical laboratory.

of an old mine tunnel. A small drag-scraper stores and reclaims the excess clinker in the tunnel, where it is kept dry. A tunnel conveyor takes the clinker from under the discharge end of the cooler to an elevator which supplies the feed-tank in the finish-grinding building. Clinker is fed from one tank and gypsum from another in the desired proportion by a set of two Schaffer Poidometers. These feed, by elevator and belt-conveyor, to two of three Smidth Kominuters. These discharge to two Hummer screens fitted with gable-feeders, the coarse going back to one of the three Kominuters. The fines from the screens go to storage-tanks which supply 4 or 6 tube-mills, 4 of F. L. Smidth and two of



Part of physical-testing laboratory showing cement-fineness determinator, tensile tester, moist closet, etc.



Equipment under ventilated hood in chemical laboratory.

Allis-Chalmers manufacture. A new dust-collecting system, consisting of large air-ducts and two cyclones (all of the company's own design) and installed in the finish-grinding building, is connected to every operating unit.

The tube-mill product goes to one of two 16-ft. Raymond mechanical air-separators, the rejects going back to the tube mill feed-bins. The fines go to

Scraper reclaiming cement from stock-houses.

one of two 6-in. Fuller-Kinyon pumps, which delivers them to two stock-houses having a total capacity of 240,000 bbl. One of these stock-houses has 7 compartments with a total capacity of 90,000 bbl. The other has one 600-ft. by 38-ft. bin with a capacity of 150,000 bbl. Cement is reclaimed from the small bins by power scrapers and from the large bin by screw-conveyors. A series of screw- and belt-conveyors feeds from both stock-houses to one pack-house equipped with 4 Bates packers. Sacks are loaded in cars by man-trucks and in motor trucks by belt-conveyor. Bulk cement can also be loaded through a chute from the main belt-conveyor leading to the pack-house.

Coal-Handling and Grinding.—Coal is brought in by railroad hopper-bottom cars and is discharged through a feeding hopper either directly into an elevator or first into a crusher. The elevator feeds either a storage equipped with a drag-line or a railroad overhead belt-conveyor, carrying the coal

to large bins ahead of the No. 15 Super Raymond mill which is of 15-tons per hr. capacity and has two pneumatic-control rotary feeders. Coal is fed to the mill with about 8 per cent. moisture; the powdered product is delivered to the kiln bins with less than 2 per cent. moisture and of a fineness that will pass 95 per cent. through 100-mesh. Only waste heat from the precoolers is used for coal drying. The mill is driven by a 200-hp. G. E. Motor. The mill fan is a No. 13 Raymond with a 75-hp. motor and the exhaust fan a No. 25 Clarage driven by a 30-hp. motor. These operations are not shown in the flow-sheet.

Office and Laboratories.—The plant office-building is an attractive two-story reinforced-concrete structure, which houses the general plant offices, private offices for the officials, and the physical and chemical testing laboratories. Numerous large steel-sash windows give ample light and prevent dust from entering the building. The chemical laboratory is completely equipped for making any necessary tests. All work is done under a hood which removes any gases created and ventilates the room. This hood has four separate working compartments, housing, respectively, a drying oven, hot plate, furnace, and still. All these are electrically-operated and each has an individual switch and red light which indicates when the equipment is operating without necessitating opening of the hood. Other equipment includes a Becker Chainomatic balance, electric ovens, still, etc.

The physical-testing laboratory is large and well-equipped. Its equipment includes a Tinius Olsen 200,000-lb. hydraulic compression tester, an Olsen tensile tester, an F. L. S. separator or flour-meter for determining the amount of flour in the cement, unusually-elaborate moist closets, and the usual scales, sieves, etc.

The moist closets are large and well-designed and have a complete control system which is well worth description. In cold weather the temperature in the moist cabinet is controlled by a Powers regulator, which releases hot and cold water in the proportions necessary to keep the temperature between 70 and 72 deg. F. This water is released through sprays, which atomize it sufficiently to keep the humidity at from 95 to 97 per cent. In warm weather a Frigidaire unit on the top of the cabinet cools the water to the desired temperature, a mercoid switch automatically controlling the freezing unit. There is also a fan, controlled from the outside of the cabinet, to circulate air through it. A Taylor automatic recording thermometer, connected to wet and dry bulbs, keeps a constant check on the temperature and humidity.

Control of Operations.—The blending of the various raw materials is begun when they are withdrawn from the raw-material storage-bins in the approximate proportions desired. A further mix is given to the material when it is withdrawn by 7 feeders from the dry-rock storage-bin. A sample of the Compeb-mill product is taken and analyzed at regular intervals for accurate final blending of the raw material, which takes place in the blending silos, where the return feed from the stack-dust chambers is mixed with the mill stream for final blending. A sample of the clinker is taken each hour and an SO_3 determination is made daily. A chemical analysis of the clinker is made twice weekly. Chemical analyses are also made each day on a composite of samples of finished cement taken each hour. These are tested for tensile strength, fineness, and setting time.

Miscellaneous.—Electricity is received at the plant at 33,000 v. and is reduced to 440 v. for plant operation. Air for drilling and other purposes is furnished by two Sullivan Class WN2 26-in. by 15½-in. by 18-in. air-compressors, each of which is driven by a 400-hp. G. E. synchronous motor. A Chicago Pneumatic 20-12 by 14-in. compressor is belt-driven by a 200-hp. motor, and a Union Steam Pump Co. compressor, driven by a 75-hp. motor, is used as a spare.

The main office of the Missouri Portland Cement Co. is at 1327 Southwestern Bell Telephone Bldg., 10th and Pine Sts., St. Louis, Mo. The company's officers are: H. L. Block, president; G. M. Block, F. B. Coleman and C. A. Homer, vice-presidents; B. G. Coyle, treasurer; and Jacob Weisheyer, secretary. Richard Uhlig is general superintendent, O. F. Schulzke is assistant general superintendent in charge of the two St. Louis plants, and V. K. Newcomer is superintendent of the Sugar Creek plant.

Feldspar Industry Experiences Drop in Tonnage and Values

The feldspar industry in 1931 was characterized by further decreases in tonnage and value of both crude and ground spar. The crude feldspar sold or used by producers in the United States in 1931 amounted to 147,119 long tons, valued at $861,059, or $5.85 a ton. These figures show a decrease of 24,669 tons of crude spar, or 14 per cent., in quantity and $205,577, or 19 per cent., in value, as compared with 1930; this is 63,692 tons, or 30 per cent., less than that of 1928, the year of maximum output, and $746,042, or 46 per cent., less than that of 1926, the year of maximum value. The average value of crude spar per ton in 1931 was the lowest since 1919, and was 36 c. lower than that of 1930, and $1.80 lower than that of 1926, the year of maximum average value. Feldspar was reported as having been mined and sold or used by the producer in 1931 in 13 states. Named in the order of their importance, they were: North Carolina, New Hampshire, South Dakota, Maine, Virginia, New York, California, Colorado, Minnesota, Connecticut, Arizona, Pennsylvania, and Nevada. The great feldspar-producing region is that which includes the Atlantic seaboard states from Maine to North Carolina. This region reported 86 per cent. of the total output in 1931. North Carolina reported 59 per cent. of the total output; New Hampshire reported 9 per cent.; and South Dakota reported 8 per cent. The average value per long ton in North Carolina was $5.85; in New Hampshire, $8.12; and in South Dakota, $3.53.

Theoretical and Practical Developments in Portland-Cement Chemistry

PART I—The Progress of Modern Research

By PROF. DR. HANS KÜHL
Director, Institute for Cement Research, Berlin

A SHORT survey of the historical development of research on cement clearly shows that the methods in use at any period present a true picture of the state of the science of chemistry. So long as chemistry developed as an independent science, free from the influence of the allied sciences, what may be termed a "pure chemical" aspect was also evident in the domain of research on cementitious materials. This was characterized by the use of analytical methods of investigation for the elucidation of the nature and structure of cements, especially Portland cement. At the time under consideration the opinion was held that Portland cement was an individual chemical compound, whose constitution could be deduced from analysis, and we may accordingly designate this period, which was about fifty years ago, as the era of "chemical-analytical" methods of research.

While the work of that time resulted in a fairly clear picture of the qualitative composition of cements and the quantitative relationships between their constituents, it also developed in directions which to-day appear peculiar. The attempts to conceive Portland cement as a chemical compound have often led to the advancement of structural formulæ which now appear fantastic. As an example I may mention Meyer's structural formula, according to which the Portland-cement molecule contained no less than 18 atoms, and must be described as a hexacalcium disilicate. Formulæ of this kind, however, appear relatively simple when we find, even in more recent times, W. and D. Asch in their ingenious investigation on the silicates, attributing to Portland cement formulæ which contain entire series of five- and six-membered rings of aluminum and silicon atoms!

Cement research was first set free from the errors into which the search for a constitutional formula had led investigators, when chemistry generally had absorbed the influence of the allied sciences —mineralogy, petrography, and, later, physics. Thus, we find as the second stage of development of cement investigation an epoch that may be termed the period of "petrographic-synthetic" methods, which owed its success to the development of the use of the microscope by Le Chatelier and Törnebohm. The recognition that Portland-cement clinker is a heterogeneous system of several clinker minerals first opened the possibility of those methods of investigation to which we owe our present knowledge of the structure of clinker, and which have continued to be of the utmost value even to the present day. The picture first sketched by Le Chatelier and Törnebohm, which provided only a skeleton for the structure of the main ingredient of clinker, was fundamentally re-investigated twenty years ago by the Russian, von Glasenapp; this work has lately been followed by a new and much more comprehensive petrographic description of Portland-cement clinker in its many varieties. All attempts to prepare synthetically those constituents of clinker recognized microscopically, and thus throw light on their molecular structure, have been fruitless so far as the general problem is concerned, although here and there individual pieces of information, which have probably brought nearer the partial solution of the problem, have been obtained. Generally, however, attempts to synthesize the individual clinker materials have led only to the negative conclusion that the structure and conditions of formation of the principal ingredient of clinker are much too complex for it to be produced by simple synthetic fusions.

This conclusion forms the starting point from which physical chemistry—which at the beginning of the present century had vigorously developed into a new science—made its attack on the problem of Portland-cement clinker. The intensely productive work on cement that has been accomplished by the aid of physical chemistry can in its turn be divided into two periods, which may be termed the "static" and the "dynamic." By static investigations is meant the application of the phase rule to the study of heterogeneous systems, in which class cement clinker falls. The study of the course of the reactions as a result of which Portland-cement clinker is formed, is termed the dynamic method.

The period of static research reached its pinnacle of achievement in the work carried out at the Geophysical Laboratory of the Carnegie Institute of Washington by the American investigators, Day, Allen, Rankin, Shepherd, White, and Wright. Their laborious researches resulted in so complete a description of the ternary system lime-silica-

This is the first of a series of six papers on the chemistry of cement, written by one of the foremost cement authorities in the world. Future installments will discuss the theory of burning, constitution of clinker, problems of hardening, and the development of high-strength cements. PIT AND QUARRY has acquired the exclusive American magazine rights to these technical treatises and is pleased to be able to present them to its readers.

alumina, that only minor corrections have since been necessary.

Almost simultaneously with this work there began, at first almost unheeded, the development of that other line of research to which I have applied the term dynamic. The first exponent of this was the American, Cobb, who studied, using relatively primitive means, the reactions that takes place when mixtures of lime, silica, and alumina are heated; he then laid a foundation for the later researches of Endell, Nacken, and Dyckerhoff on the incomplete equilibria of both the ternary system and the cement raw meal of practice, which gave an insight into the structure of Portland-cement clinker, greatly surpassing that attained by the Americans from their study of the equilibrium conditions. Investigations have also been carried out in my own laboratory on the course of the reactions which proceed on heating cement raw meal to clinkering temperature, and I shall endeavor to demonstrate later that this dynamic method of research offers every hope of enabling us to lift the last veil with which the theoretical aspect of the cement problem is still shrouded.

It would, however, be a fallacy to suppose that cement research can only be advanced by the use of the most accurate methods of mineralogy and physical chemistry. On the contrary, it would seem that the technical utilization of our scientific knowledge—the ultimate object of all science—will not be attained by the three methods mentioned, but by a fourth, which may be termed the "synthetic-technical." It may seem strange to suggest that technical methods are in advance of purely scientific methods. But it must be borne in mind that cement is a technical product, and that by far its most important and interesting property is that of hardening, which can only be expressed in terms of strength units of a purely technical nature. It might even be said, as a result of the experience of the past few years, that without technical strength tests there would be no cement research. Undoubtedly that is somewhat of an exaggeration, but it must not for a moment be forgotten that it is of the utmost importance to supplement the results of abstract scientific research by means of technical strength tests.

When one considers the more important investigations of the earlier decades—among which are included not only those of the Carnegie Institute, but also those of other workers and, above all, of Otto Schott—it appears that the results would have been of a great deal more value if, in addition to the thermal and optical data of the products obtained with so much zeal and trouble, information were available as to their technical cementitious value. Is it not unsatisfactory when one has prepared such difficult substances as α dicalcium silicate, tricalcium silicate, or ternary compounds such as "Jäneckeite," to be without means of evaluating their cementitious properties and, above all, their hardening capacity by means of strength determinations? In a few isolated cases investigators who have studied these substances scientifically have made a limited number of strength tests: for example, Schott, who established that dicalcium silicate possesses the property of hardening to a far lower degree than Portland cement, and who found that a melt which he claimed to be tricalcium silicate showed expansion, but that a product capable of a high degree of hardening was obtained by mixing the tricalcium silicate with about 4 per cent. of alumina before burning. In contrast to these few experiments, in which scientific cement research is combined with technical strength tests, we have far too great a number of investigations which, although they led to valuable scientific results, failed to give any direct connection with the practical aspect of cement owing to the lack of strength tests.

And from the opposite point of view. What an abundance of work has been carried out under difficult conditions with the object of gaining a new insight into the structure and properties of cement by means of semi-technical test burns! Individual burns, in which some 10 to 45 lb. of raw meal is ground in a laboratory ball-mill and burned in a coke furnace with considerable excess of fuel, the more or less slagged clinker being finally ground in the ball-mill, are unreproducible and thus quite unscientific; the number of uncontrollable factors that affect the course of the reaction is so great that the results of individual experiments can only be considered to be fortuitous. Nevertheless, it has been necessary to be satisfied with so primitive a process during several decades, and I have often had to toil with it myself, simply because no better method was available. Success has nevertheless been obtained from this inadequate method by laboriously collecting an immense number of results. If a hundred test burns are systematically carried out, a general relation between them will ultimately be found in spite of the uncertainty of the individual experiments; it is in this way that research has utilized the results of the ordinary type of test burn.

In this connection I have been convinced for many years, as a result of a great deal of serious thought, that further progress can only be made by the provision of a process for the preparation and testing of specimens capable of application both to pure scientific research and to practical cement burning and testing. The problem to be solved was to some extent a double one. On the one hand it was necessary to evolve a process of making strength tests that could be applied to small quantities of scientific preparations, and on the other hand it must be possible to reproduce in the laboratory the normal plant process of manufacturing Portland and other cements with an exactitude as great as or greater than is obtainable on the technical scale. I believe that in the past few years I have to all intents and purposes solved both these problems.

While during many decades it has been deemed sufficient, for producing Portland and other cements in the laboratory, to imitate the normal plant processes on a small scale, I have made the innova-

tion of applying to these technical processes the exact research methods of physical chemistry. For burning I have replaced the laboratory shaft or rotary kiln by the electric tube or muffle furnace.

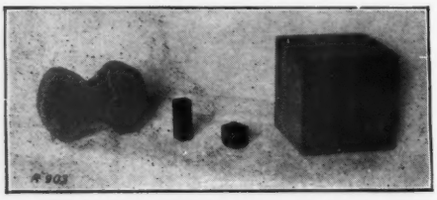


Fig. 1.

While 10 to 45 lb., or even greater quantities, of cement can be produced in the ordinary small shaft or rotary kiln, I am content to burn quite small quantities of 50 to 100 g. It is possible to make such small quantities suffice because a process has been worked out in my laboratory which allows a complete set of technical tests—setting time, soundness, tensile and crushing strengths, and all other properties of technical importance—to be made on very small quantities of cement. Before describing this, however, I will deal with the method of cement burning in the electric furnace.

By utilizing the electric furnace for the production of small amounts of cement we gain the possibility of defining the working conditions much more accurately than is possible with technical furnaces. Thus, a small quantity of cement can be burned in the electric furnace free from the influence of ash and furnace lining, and independent of the effects of chimney draft and many other uncontrollable factors by which the technical process is affected. Further, a definite rate of heating and temperature of burning can be precisely maintained for any desired time, thus raising the production of cement to an exact process, of an accuracy in no way inferior to that aimed at and attained in the preparation of synthetic products in other branches of chemistry.

For the preparation of the raw mix I use a small porcelain mill of about 1-l. capacity. By suitably regulating the ball charge and the time of grinding I can accurately reproduce the fineness of the raw meal, even when using raw materials of different degrees of hardness. After leaving the porcelain mill, the raw meal is moistened with water and molded by hand into small balls about the size of a hazelnut, or into small bars the size of the little finger. The balls are burned in the muffle furnace and the bars in the tube furnace.

The furnace-lining problem at first appeared difficult, but it has been solved by placing the material to be burned on platinum. In charging the muffle furnace the balls of raw meal are piled up on a flat platinum sheet with a turned-up rim, while for the tube furnace the bars are wrapped in platinum foil before introduction to the furnace. The use of a platinum support is of still greater value when it is required to produce fused instead of sintered cement. As long as I used flat-bottomed platinum basins for the fusions I experienced the difficulty that the fused mass could not be separated from the basin without the use of a chisel, which, of course, always resulted in the destruction of the basin. The difficulty was overcome by the use of platinum sheet with turned-up edges in place of the platinum basin. On the completion of the burning, after cooling, the bent-up edge of the thin sheet was straightened out, and the metal could then be removed from the cake of solidified melt like the peel from an orange.

I have found the platinum resistance tube furnace and the slit-rod resistance furnace particularly well adapted to the burning process. A temperature of 1,450 deg. C. can be attained in the tube furnace and 1,550 deg. C. in the slit-rod furnace. The use of still higher temperatures offers no fundamental difficulty, since methods of constructing furnaces for use at such high temperatures are well known. I have not yet used extremely high temperatures, and I am by no means clear as to how reaction between the cement mass and the support can be avoided under such conditions. Perhaps the replacement of platinum by iridium is the only solution to this problem. The use of foil of tungsten, molybdenum, or other metal of high melting point can not be considered for cement burning, since all these metals withstand furnace conditions only in a reducing atmosphere, which is out of the question in the case of materials containing iron oxide.

For grinding the clinker or other product the porcelain ball-mill is again used. The mill works admirably and yields a very uniform cement meal so long as care is taken to insure a sufficient preliminary breaking-up of the clinker. To make certain of this the material is broken in an iron mortar or, for especially accurate work, in an Achat mortar to such a degree that it completely passes through a sieve having 50 meshes to the linear inch.

For testing the small quantities of cement obtained by this process I have constructed a series of apparatus of which photographs are shown.

Fineness can obviously be determined on small quantities of material with sufficient accuracy by using the ordinary sieves. I will postpone the description of methods capable of giving a deeper insight into the granular composition of cement until high-strength cements are discussed.

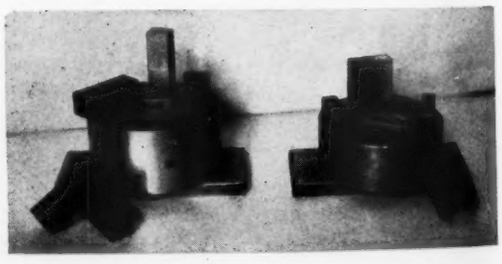


Fig. 2.

The setting time and soundness of these small quantities of burned material are tested in a single process with the object of attaining the utmost economy. A small appliance, similar to the Le Chatelier callipers, was designed. It consists of a small nickeled-metal ring with a capacity of 2 c.c. This ring forms the vessel in which the setting time is determined. It is laid on a glass plate and filled with cement paste, the initial and final set being determined with a small needle apparatus modelled on the Vicat needle. It is necessary, of course, to work with a much finer needle than that of the

Vicat apparatus, whose coarse needle would split asunder our small test-piece in the course of setting. As a result of experiment the small apparatus is so designed that it gives practically the same values of initial and final set as the full-sized Vicat apparatus.

The small test-piece used for the setting-time determination serves also, after hardening, for the soundness test. As a rule I use for this purpose the steam test as carried out by Le Chatelier. The two pointers on the opposite sides of the slit in the ring open when the cement is not sufficiently sound, exactly as with the ordinary Le Chatelier apparatus.

By far the most difficult problem is to evolve a process for strength testing so that the test pieces can be produced from a very small quantity of cement. Such a process has been developed, both for the measurement of tensile strength (or more accurately bending strength) and crushing strength.

For the bending test small bars of 1 cm. side and 3 cm. length are used; for crushing strength, small cubes of 2-sq. cm. face. The resulting saving in material as compared with the large test pieces of the standard tests is considerable; for the ordinary tensile test 50 g., and for the ordinary crushing test 200 g. of cement are necessary, *i. e.*, 250 g. for the two; by contrast I require for the same purpose

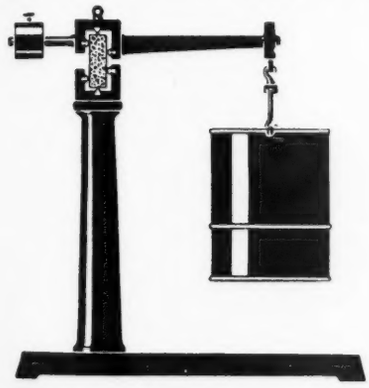


Fig. 3.

only 3 g. of cement. Fig. 1 shows the standard and miniature test pieces side by side; the difference is extremely striking.

For the preparation of the small bars and cubes a mixture of 1 part cement and 3 parts of special sand, which is called standard sand is used for the miniature testing process. This sand is obtained by grinding ordinary standard sand for a short period in a ball-mill and then taking the fraction between two sieves, exactly as in the case of ordinary standard sand. This miniature process sand is, by linear measurements, half as coarse as standard sand, and 1 grain of standard sand averages in volume 8 grains of minature-process sand. The sieving is carried out by means of the German standard sieves Nos. 14 and 30.

The mixture of 1 part cement and 3 parts miniature-process sand is not tamped, but pressed into the molds. For this purpose an iron mold through which a rectangular stamp passes is used. Fig. 2 clearly shows the heavy iron mold with the hole for the stamp. The added water is measured and is exactly 11 per cent. It has been possible to adopt this fixed quantity because, on briquetting the mass, a small excess of water exudes from the form, so that the briquette absorbs exactly the quantity of water needed to give it the right consistency. The briquetting is carried out under the ram of a hydraulic press using a load of 100 kg. per sq. cm. (1,420 lb. per sq. in.). By driving in the ram the prepared briquettes are forced partly out of the mold, so that the portion remaining has the prescribed thickness. The excess mortar is then scraped off, the surface smoothed, and the briquette forced completely out. The test pieces are carefully placed on a glass plate, and allowed to harden for the first 24 hr. in a space saturated with water vapor. They may then be stored in water or air.

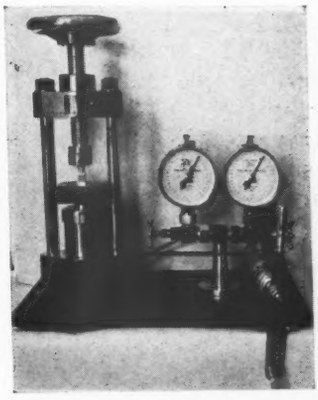


Fig. 4.

For testing the small bars a lever apparatus (Fig. 3) designed on the same lines as that used by Feret for determining the bending strength of larger prisms is used. On the top of the support is a jaw in which the small test bar is inserted, while a movable jaw, forming part of a lever arm, grips it from above. The load is applied by running lead shot into a container at the end of the lever. At the instant of breaking the container falls away, and the supply of shot is thereby cut off. The weighed load must be multiplied by ten to give the value which is designated the "miniature-process tensile strength."

Great difficulty was at first experienced in carrying out the crushing test owing to the small size of the cubes, as it appeared impossible to avoid lateral shear of them. As a result of this the strength values were extremely divergent, and reliable averages could not be obtained. Even with a special press (Fig. 4), placed at my disposal by the Clay Industry Laboratory in Berlin, I was unable to overcome this difficulty. At last, however, I succeeded by interposing a small, freely moving, ball-and-socket joint between the press and the ram, which made it possible to apply pure compression to the test cube. As a result of this, failure now occurs regularly in such a manner that the pyramids formed fit well together.

The strength values obtained by the miniature testing process are much lower than those of the standard process. The reasons for this are the use of a finer sand, producing test pieces by pressure instead of by tamping, and the very small dimensions of the test pieces. By multiplying by two the strength figures obtained in the miniature proc-

(*Continued on page 44*)

Olympic Portland Cement Co. Completes Novel Single-Line Tramway

AT the limerock quarries of the Olympic Portland Cement Co., near Limestone, Wash., an aërial tramway has recently been completed and put in operation. This tramway conveys lump rock from the quarry floor to the loading spur of the C. M. St. P. & P. R. R., a distance of about 2,300 ft., with a total drop of about 1,100 ft., and discharges its material directly into the cars instead of into a bunker. Certain characteristics of the quarry operation necessitated detaching the unloaded skip from the tram cable, lowering it about 30 ft. to a skip buggy, and taking it to the rock pile on the quarry floor about 300 ft. distant for loading. This prevented the use of the two-bucket balanced system, in which the loaded bucket traveling down pulls the empty bucket up the incline, and so a tension-weighted, single-line, single-skip system, controlled by a single-drum hoist with its motor running regeneratively while the skip is being lowered, was chosen.

The towers and terminal structures are entirely of wood. The intermediate towers, three in number and varying in height from 40 to 70 ft., are built of logs and poles out in the near woods, while the loading and discharge terminals are built of heavy sawed timbers. The tension weight is a solid block of concrete which weighs 50,000 lb., and is suspended from the lower end of the track cable. The latter is of plow steel, 1½ in. in diameter and of a lay specially suitable for this work. The hauling cable is of ¾-in. 6-19 plow steel, furnished by the P. S. M. M. S. Co. of Seattle.

The tower saddles are of special pivoted pendulum type designed and patented by A. B. Newell of the Newell Tramway & Engineering Co., Seattle, Wash., and the carrying rolls and traveling carriage were also designed by him.

The hoist is a single-drum 48-in. by 30-in. machine made by the Ottumwa Iron Works and is driven by an 80-hp. 220-v. 3-phase motor of the General Electric wound-rotor type, directly geared so as to give a line speed of 800 ft. per min. This motor runs regeneratively while lowering the loaded skip and has a peak output of 75 kw. on the down trip and a peak input of about 67 kw. when hauling up the empty skip.

The skips, with detachable bails necessitated by the method of discharge and loading, were designed by Burton B. Pierce of Seattle, and are of 2½-ton capacity. The automatic discharge of these skips at a distance of over 2,000 ft. away from the operator, necessitated the development of the so-called trapeze dump in which Mr. Pierce collaborated with A. F. Krabbe, general superintendent of the Olympic company. Two heavy hooks are riveted to the bottom of the skip at the rear end. These engage a trapeze bar suspended from the frame of the terminal at the proper place for the discharge. This bar is a piece of extra heavy 4-in. pipe pivoted on a 2½-in. pipe suspended by chains at the proper height. The track cable here has an incline of about 28 deg. and the carriage traveling down lowers the front end of the skip while the trapeze, swinging forward in its arc, raises the rear end until the skip reaches an angle of about 50 deg. when the load is discharged upon a ramp down which it slides into the car below. The skip is then started on its return trip by a signal from the car trimmer.

The tramway has a rated capacity of 100 tons in 8 hr., but, under the efficient supervision of F. E. Ristine, quarry superintendent, and his trained men, is regularly exceeding this output. With a crew of two operators it is displacing the five trucks and drivers formerly required for this work and is making about a 60 per cent. reduction in the cost of transportation.

The construction work was in charge of Burton B. Pierce as engineer and foreman of construction.

Loading station in quarry.

Unloading point and incline.

The trapeze dumping device.

Foresight of the Tylers Has Kept Dewey Plants in Vanguard of Progress

Improvements at Company's Oklahoma Mill Reflect Ability to Analyze Future Trend

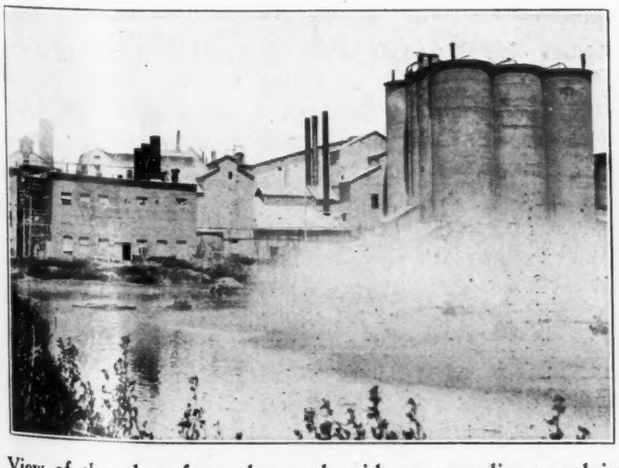
ONE of the characteristics of the Portland-cement industry is that it never stands still, satisfied with the results it has achieved. The industry is always progressing. For many years this progress was manifested almost entirely in increased productive capacity with comparatively little attention being paid to economy of operation. New plants sprang up in all parts of the country and many companies built additions to their plants in order to increase capacity. Since the decrease in the demand for cement during the past few years began to be felt, however, the trend has been toward promoting economy of operation, and practically all improvements being made in cement plants have this purpose in mind.

One of the first to sense the importance of cutting production costs was the Dewey Portland Cement Co., which in 1930 began an impressive reconstruction program at both its plants. This program has resulted in considerably lower costs, a better and more consistent quality of product and, incidentally, some increase in capacity. A complete description of the improvements at the plant at Davenport, Ia., a wet-process plant, was published in the April 8, 1931, edition of PIT AND QUARRY. The present article describes the improvements recently completed at the Dewey, Okla., plant, a dry-process operation. Credit is due Frank E. Tyler, president of the company and H. F. Tyler, D. M. Tyler, and W. E. Tyler, vice-presidents, for their foresight in analyzing the trend of the industry before it became evident to most other operators.

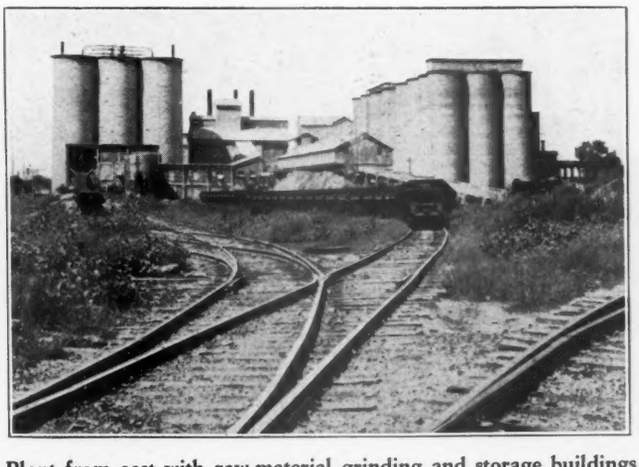
The history of this family of cement manufacturers dates back to 1904, when D. W. Tyler, father of the present officers of the company, became interested in the American Portland Cement Co., at Neodesha, Kan., of which his son, F. E. Tyler, became treasurer and general manager. The name of this company was later changed to the Indian Portland Cement Co., which sold out to the Sunflower Co., and in 1906 its plant was dismantled. The Dewey Portland Cement Co. was incorporated in 1906 and the plant, with a capacity of 700,000 bbl. per year, was erected soon thereafter. This has been increased from time to time until its capacity is now 1,500,000 bbl. per year. F. E. Tyler was made president and general manager of the company and has been active in those positions ever since.

The company has always, since its inception, been one of the leaders in developing and adopting new methods and equipment to decrease costs and improve the product. The Tyler family had for many years been flour millers and had used concrete silos successfully for grain storage. The company decided to apply this method of storage to the cement industry and, in coöperation with the Macdonald Engineering Co., in 1909 designed and built the first installation of this kind in the industry. The first unit consisted of four silos of 17,000-bbl. capacity each. Later, on two different occasions, additional units of the same size and capacity were added and also 6 silos of 7,000-bbl. capacity each. All these were built by the Macdonald company.

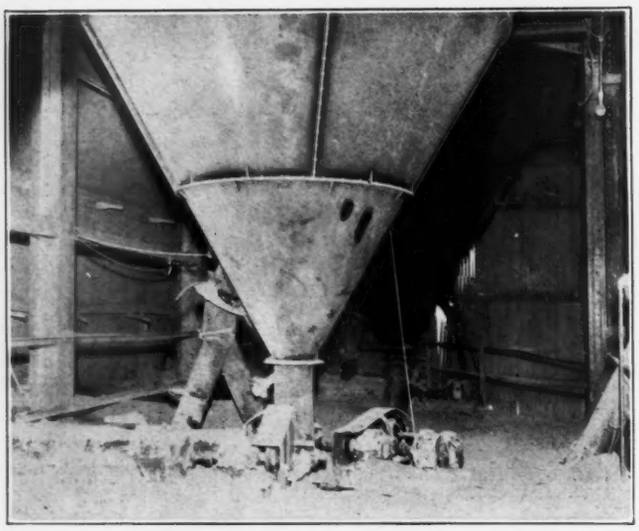
The company's next important move was the erection of a new and modern wet-process plant at Linwood, near Davenport, Ia., in 1927. In 1930, in order further to decrease costs and improve quality at this plant, the company installed the first closed-circuit wet-grinding system in the industry. This system had been used successfully for many years in ore mining and its success at this plant would indicate a possibility that it might become



View of the plant from the south with spray-cooling pond in foreground and raw-blending silos at right.



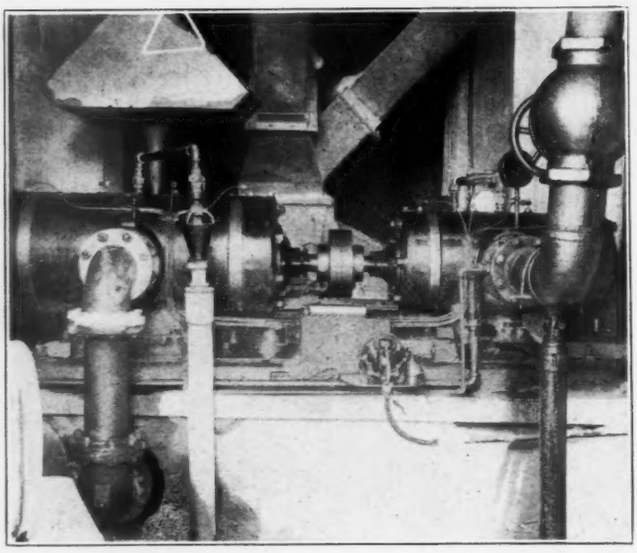
Plant from east with raw-material grinding and storage buildings in foreground. Blending silos, left, cement silos, right.



Two of the three 16-ft. separators in the raw-grinding building.

equally popular and efficient in the cement industry.

At the same time a number of important improvements were made at the Dewey, Okla., plant. These included the installation of a Fuller-Kinyon dry-blending system, with its accompanying equipment, and eight 32-ft.-diameter and 90-ft.-high concrete blending silos; the lengthening of one of the six 8-ft. by 9½-ft. by 105-ft. kilns to 150 ft. with a calcining zone 14 ft. in diameter and 21½ ft. long; and the installation of seven 16-ft. Sturtevant air-separators in the raw- and finish-grinding departments. The most recent installations were a Bradley Hercules mill in the finish-grinding department and a Richardson scale for batching to



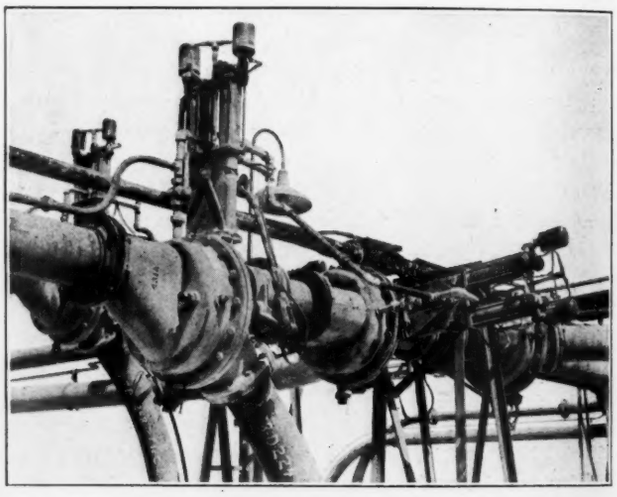
One of the two rotary air-compressors beneath the blending silos.

the mills. An Edgemoor waste-heat-boiler installation made in 1920 supplies all the power required by the plant.

Quarrying, Crushing and Raw Grinding.—The raw materials used are quarried within a few miles of the plant. The high-lime quarry is about a mile from the plant and has from 1 to 7 ft. of clay overburden. This is stripped in winter by the shovel used in the quarry and is hauled in old Continental side-dump cars to the worked-out section of the low-lime quarry which is a mile farther from the plant. The shovel there rehandles the overburden. By this method 20,000 cu. yd. of waste can be handled before it becomes necessary to shift the tracks. In the low-lime quarry the overburden consists of from 4 to 5 ft. of broken stone mixed with clay, which is not removed. Seams of shale between the rock strata are also not removed.

Drilling in both quarries is done with Keystone electric well-drills using 5⅝-in. bits. The faces vary in height from 16 to 22 ft. Shots generally consist of from 75 to 225 holes arranged in from 4 to 8 staggered rows. Trojan 40-per cent. dynamite is used. Water for the quarries is furnished from an old quarry near. This has been stocked with bass and crappie and affords excellent fishing for the employees and their families. A private amusement park with swings, benches, tables, swimming hole, etc., is also maintained.

Stone is loaded by two 3-cu. yd. Bucyrus 100B electric shovels, which load 8-cu. yd. Koppel steel side-dump cars that are hauled to the plant by 25-



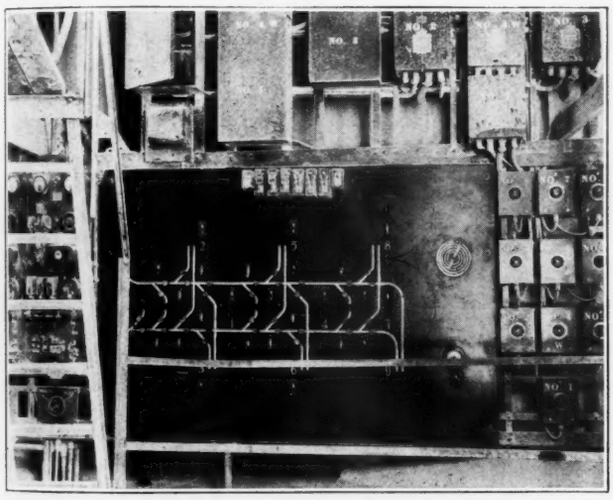
Electrically-controlled pneumatic valve on the top of the blending silos.

ton Vulcan and Davenport steam locomotives. At the plant the cars are hauled one at a time up a short incline and dumped by means of an air-cylinder into the 48-in. by 60-in. primary jaw crusher. A belt-conveyor feeds the output to a large revolving screen which has 1-in. perforations. The coarse material is high-lime and goes to a set of rolls for further reduction. The fines or low-lime and the high-lime product of the rolls are fed to separate parallel inclined belt-conveyors which discharge the materials to individual drier-feed bins. The coarse rock goes through a Williams No. 7 Jumbo hammer-mill before going to the driers. Two of the three rotary driers are used for coarse, the third one for fine material. The driers discharge to three storage-bins from which the material is fed in the desired proportions to elevators which discharge to the mill-feed bins.

Table-feeders discharge to two Bradley Hercules mills which are fitted with 5-mesh screens and are used for preliminary grinding. Each feeder motor

is connected to a relay in the circuit of the mill motor so that, in case of an overload on the mill motor, the feeder is shut off until the load is again normal. Final raw grinding is now done by four 6-ft. by 22-ft. Allis-Chalmers tube-mills operating in closed circuit with three 16-ft. Sturtevant separators, fed by Fuller rotary feeders. The mill discharge goes to the separators by screw-conveyors and elevators in the usual manner. The coarse from the separators is chuted back to the mills, while the fines are chuted to a 10-in. Fuller-Kinyon pump which feeds the raw-material blending silos.

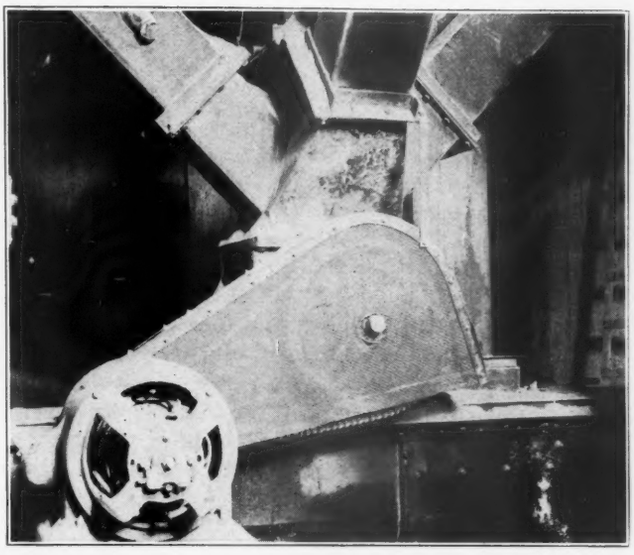
Originally there were 5 tube-mills but when the air-separators were installed, one was taken out. The 4 now in use are producing more material, ground to a more consistent degree of fineness, than all 5 mills did under the old system. They operate under a circulating load of about 20 to 25 per cent. Each mill discharges to the separator from 36 to 37½ tons per hr. of material passing 75 per cent. through 200-mesh. The coarse passing from the separator back to the mill runs from 6 to 7½ tons per hr. The finished fine material from each separator is about 30 tons per hr. and runs about 85 per cent. minus-200-mesh.



Control-board of automatic raw-blending system with pump controls at left and rotary-feeder controls, right.

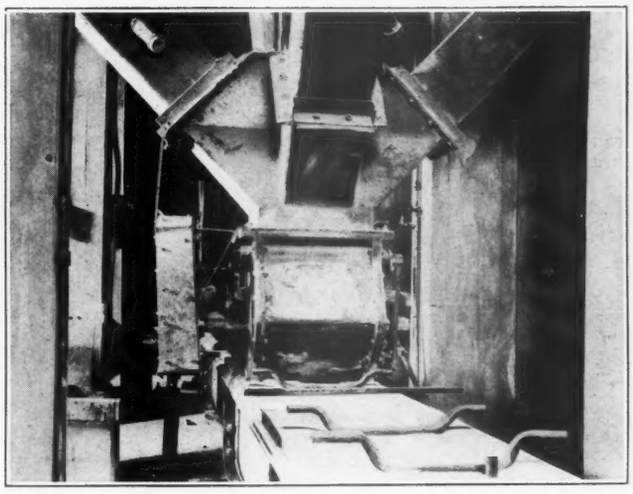
Raw-Material Blending.—The storage for the raw material consists of 8 reinforced-concrete silos, each 32 ft. in inside diameter and 90 ft. high. These are arranged in the form of a square with three silos on each side, thus providing a larger central space which is used as the ninth silo. This system has a total capacity of about 90,000 bbl. When it was first installed, the raw material was automatically run at intervals into each of the silos in turn, but this method was soon abandoned and each silo is now filled before the feed is switched to another silo. Fuller-Kinyon pneumatic valves, electrically-controlled from the control-board, allow the pump stream to discharge to any desired silo. The rough blendings at the quarry and in the crushing plant keep the proportions fairly close to those desired.

The bottoms of the silos are supported on concrete foundations. Each silo feeds through Fuller-rotary valves to five square steel spouts which are under it and connect to 8 Fuller rotary feeders. The valves are controlled by chain from the floor and have air connections to keep a steady flow of raw material. The central storage-space supplies two feeders. Three 18-in. screw-conveyors, 72 ft. long and running parallel under this storage, collect from five of the silos and the central space and discharge to three parallel 18-in. screw-conveyors, each 36 ft. long, which collect from the three remaining silos. In the same manner two of these screws discharge to an 18-in. collecting screw-con-

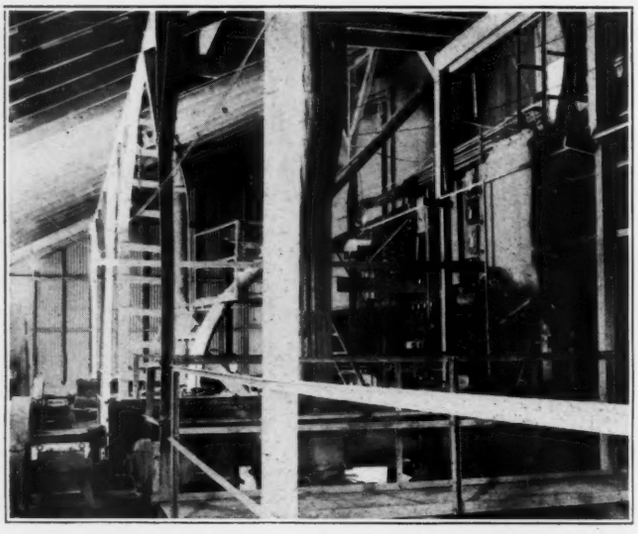


Variable-speed motor driving one of the rotary feeders. Note five spouts from blending silos.

veyor, 72-ft. long, which also takes the discharge of the third screw coming from the silos. This unusual arrangement was made so that each of the screw-conveyors would carry approximately the same load and could use the same size motor. Each of the 8 screw-conveyors is driven by a 25-hp. Allis-Chalmers motor through a Link-Belt double-reduction herringbone-gear speed-reducer and Link-Belt roller-chain, and a flexible coupling of the same make. Timken roller-bearings are used on the screws. Each of the ten 19-in. by 20-in. Fuller rotary feeders is driven through roller-chain by a 7½-hp. Crocker-Wheeler direct-current variable-



Another feeder view showing spouts and screw-conveyor.



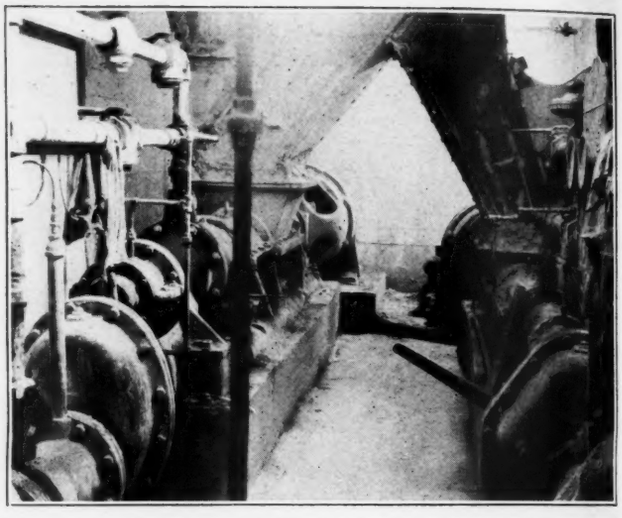
Automatic control-board with sampler at right.

speed motor with a built-in speed reducer. The feeders are controlled by push-button switches at the control-board as well as by local switches.

The collecting screws discharge through a double hopper to two Fuller-Kinyon pumps in a concrete pit. One of these, an 8-in. unit driven by a 75-hp. Westinghouse motor, discharges to the feed-hoppers of the kilns. This pump gets a full feed at all times and the overflow goes to the 10-in. pump which recirculates the surplus material to the blending silos. The latter unit is driven by a 100-hp. motor. The final blending is thus accomplished by drawing material from the silos in the desired proportions, and a further mixing is secured in the recirculation of some of this material. Air for the Fuller-Kinyon pumps and for agitation is furnished by two Fuller two-stage rotary compressors, each rated at 700 cu.ft. per min. with a maximum pressure of 90 lb. Each compressor has a Reed air-filter and is driven by a 150-hp. Westinghouse synchronous motor. A Chicago Pneumatic compressor, rated at 700 cu.ft. per min. and driven by a 150-hp. motor, is kept in reserve.

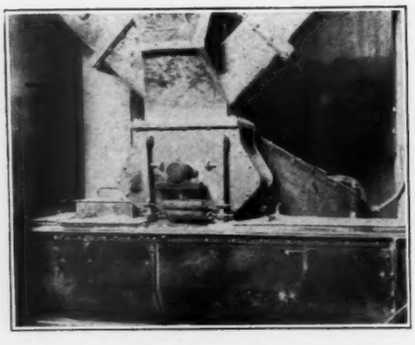
The discharge of the pipe-line from the 10-in. pump is controlled by Fuller-Kinyon pneumatically-operated valves, which are electrically controlled from the control-board near the pumps. Usually the valves are operated by an automatic timing device on the board, which allows the pipe-line to discharge to the silos in regular sequence at any desired interval between 2 min. and 48 min. Should anything go wrong with the control mechanism these valves can be operated by manual switches on the board.

The control-board has a lay-out of the blending silos painted on it, white lines indicating the pipe-lines and small lamps marking the locations of the valves. The lamps are connected so that they light when a valve is open and are dark when it is closed. In this way the flow of material can always be instantly determined. A 3-way lever switch at each pair of lights can be used for manual control of the flow. When in the middle position the valves are part of the automatic-sequence operation. The returns from the 10-in. pump are being operated in automatic sequence. The feeders under the silos are operated by push-buttons alongside the control-board, and individual rheostats control the rate of feed. Push-buttons for starting and stopping the two pumps in the pit and the screw-conveyors under the silos are also located here. These are electrically interconnected so that the pumps start first, and then the screw-conveyors in the reverse order of flow. When stopped, the sequence is in the opposite order. A shut-down of any one of these units also automatically stops the others in sequence.

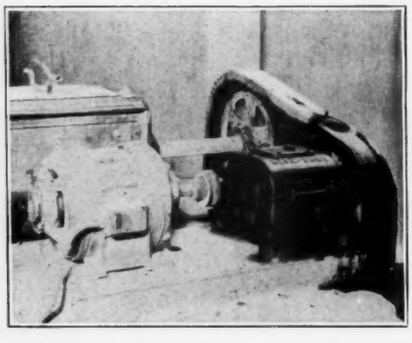


Pumps operated in connection with raw-material-blending system.

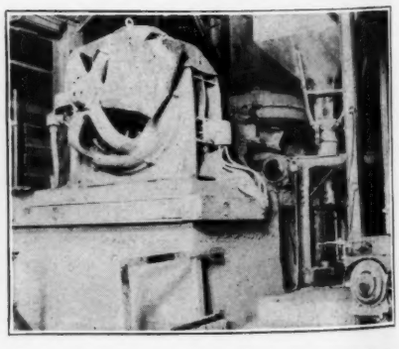
An interesting feature of this blending system is the automatic sampler which works in conjunction with it. This takes a sample every time the valves



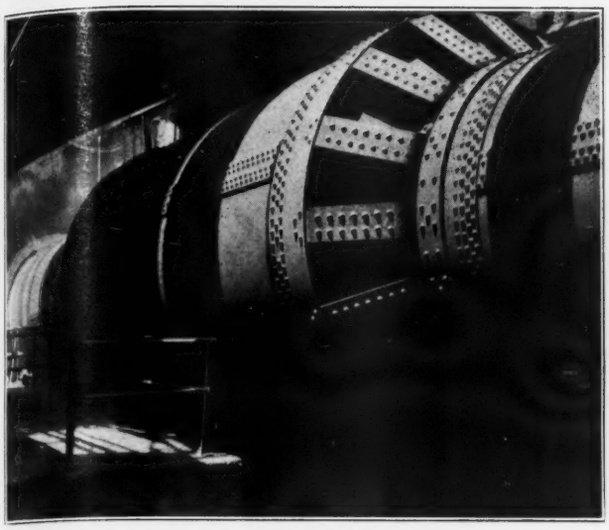
One of the roll-feeders with relief spring protecting it from tramp iron.



A typical screw-conveyor drive of which there are several in the plant.



One of the two original ring-roll preliminary finish-grinding mills.



Enlarged calcining zone of one of the six kilns.

P. R. Chamberlain, superintendent, and R. A. Loveland, chemist.

above the silos are changed, which, at present, is every 4 min.

The sampler, which was designed by the company, automatically splits the stream 5 times so that 1/32 of the amount is retained for the sample. The balance goes by gravity back to one of the conveyors feeding the Fuller-Kinyon pumps. The material is fed to the sampler through one of a pair of Fuller-Kinyon pneumatic valves on the line leading to the silos connected with the control system. As each valve change is made this system

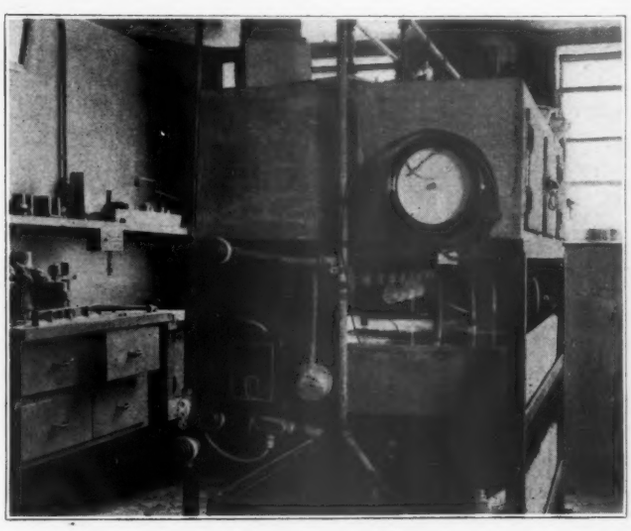
The new finish-grinding ring-roll mill.

diverts the flow for a fraction of a second to the sampler. From the sample taken the chemist calculates the percentages to be taken from each silo to give the correct blend.

Burning, Clinker Grinding and Storage.—Burning is done by 6 rotary kilns. Five of these are 9½ ft. by 8 ft. by 105 ft. long. The sixth unit was originally of the same size but has been enlarged to 150 ft. by adding a calcining zone 14 ft. in diameter. A Bailey coal-feeder was also installed. These changes increased the capacity of this kiln from 700 to about 1,200 bbl. per day and reduced its fuel consumption about 12 per cent. They also decreased the free-lime content of the cement and resulted in a more even control of the CaO content.

In the finish-grinding department preliminary grinding is also done by two Bradley Hercules mills. These feed four 6-ft. by 22-ft. Allis-Chalmers tube-mills which operated in closed-circuit with four 16-ft. Sturtevant air-separators which increased the capacity of each mill on account of the circulating load. Each mill feeds approximately 100 bbl. per hr. of 76-per cent. minus-200-mesh material to its separator. The coarse returned to the mill by the separator varies from 20 to 35 bbl. per hr. of 30- to 55-per cent. minus-200-mesh. The finished cement—90 per cent. minus-200-mesh—discharged by each separator averages about 65 bbl. per hr. A third Bradley Hercules mill, recently installed in the finish-grinding department, supplements the other two and is also used in the manufacture of two special cements recently added to the list of products of the plant.

Miscellaneous.—Another feature of this plant is the completely-equipped laboratory maintained in the basement of the plant office-building. This contains the usual chemical- and physical-testing



Moist closet of original design in the laboratory.

equipment, including a Riehle briquette tester, etc. There is a Fisher Scientific Co. cube tester which has a capacity of 25,000 lb. and facilities for pressure correction. The chief feature, however, is the moist closet, which was designed by R. A. Loveland, plant chemist. This consists of a 3-level welded-steel frame, the two lower levels consisting of tanks for briquettes and cubes. The third level consists of 5 moist boxes of copper covered with Aërocrete. Water trickling down the sides of these boxes and constantly circulating through the tanks regulates the temperature and humidity. A small pump, driven by a ¼-hp. motor, circulates the water. A small 1-hp. Mayflower refrigerating unit with mercoid control cools the water in warm weather. Batteries of 120-v. electric lights over the two tanks heat the water in cold weather and are under automatic control. By this means the temperature is kept at all times at 70 deg. F. plus or minus 2 deg. as recorded by a Brown recording thermometer. The moist boxes are kept at a humidity of about 97 per cent.

The main office of the Dewey Portland Cement Co. is at 101 W. 11th St., Kansas City, Mo. The officers are: F. E. Tyler, president and general manager; H. F. Tyler, vice-president and manager of the Davenport plant; D. M. Tyler, vice-president and manager of the Dewey plant; R. W. Moore, vice-president and secretary; and W. E. Tyler, vice-president and treasurer. P. R. Chamberlain is general superintendent and divides his time between the company's plants. R. A. Loveland is plant chemist.

The Progress of Modern Research in Portland-Cement Chemistry

(*Continued from page 37*)

ess, in the case of both crushing and tensile tests, we obtain values very close to those given by the standard process.

The new process offers many advantages, one of the most important being the small space required. Two-liter vessels for storing the test pieces are quite large enough. These should be corked so that the evaporation of water and the formation of a crust are impossible. Still more important, the amount of liquid used for storage is relatively great compared with the quantity of material. Thus, the composition of the liquid does not appreciably vary even when there is an active exchange between the liquid and the test pieces.

Even though the individual test results do not accurately agree with those obtained by the standard process, this is a minor disadvantage compared with the enormous advantage of being able to compare the strengths of precisely defined scientific preparations with reliability and accuracy. We have at last, in this means of comparison, a key to the solution of the future problems of cement research. To my mind it represents an important advance that costly scientific preparations, such as those obtained by the workers of the Carnegie Institute, can henceforth have their cementitious strength determined, so that their most important property from the point of view of the cement technician can be judged parallel with commercial cements. I believe an extension of this union of science and practice will lead to the elucidation of those technical questions to which scientific research on cement has hitherto been unable to find an answer.

(To be continued)

Alabama Plants Await Resumption of Road Work and Construction

JUST what the South's consumption of cement will be within the next decade is, of course, problematical. Yet on this consumption will hinge the future of Alabama's cement mills. What this aggregate may be, must, in a measure at least, be estimated by the manner of consumption during the past decade.

A survey brings to light these facts: Of the South's total output of cement, 35 per cent. went into road construction, construction projects absorbed around 25 per cent., river, harbor and dam work used about 20 per cent., to the railroads is credited 5 per cent., and the remaining 15 per cent. was utilized on the farms.

However, until industrial stagnation began to be felt generally over the South, the percentages changed somewhat from the given averages. Road construction, up to this point, was absorbing close to 65 per cent. of the gross output, while the ratio of general construction went 5 per cent. over the average, or 30 per cent., leaving 5 per cent. for general absorption.

The Birmingham District is geographically in the very center of Dixie, and is likewise strategically located, as are few cities, for production and distribution. The cement mills have the advantage of limestone in unlimited quantities, vast fields of coal, electric power, shale and clay, all within a convenient area. Sharing these natural advantages of materials and distribution facilities are six large cement mills, having capacity for an annual output of nearly 8,000,000 bbl.

These mills, manufacturing Portland cement, are equipped to meet the demand their respective officials are confident will be made on them in the near future. Nor is this confidence without substantial foundation. Road-construction programs are pending all over the South. In Alabama alone there are several thousand miles of primary roads ready for hard-surfaced paving. It is an admitted fact that Dixie is far behind the East in hard-surfaced roads. A stale bond market has held up concrete sewerage improvement programs in many cities. The consumption in this work alone will be enormous.

It is a natural conclusion that, with three years of virtual stagnation in the building industry, a demand which must be filled when credit eases, has been developed for cement. Alabama looks with "heads up" to the future in her cement industry.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

Photo by Strauss

H. F. THOMSON

Vice-President and Secretary
General Material Co.
St. Louis, Mo.

Personal Mention

C. A. Menzel, an associate engineer of the Portland Cement Assn., has been awarded the Charles B. Dudley medal by the American Society for Testing Materials for his important researches in the fire resistance of concrete walls.

S. C. Hadden, secretary of the Indiana Sand & Gravel Assn., addressed the Scientech Club of Indianapolis on June 20, presenting the views of truck owners on the new Indiana truck and motorbus law which limits the weights and sizes of motor vehicles and which went into effect July 1. Validity of the law was recently upheld, as an article in the last issue explained.

H. C. Mandeville of Elmira, N. Y., was elected president of Worcester Salt Co. to succeed Lorenzo Benedict who died May 16. Formerly president of Remington Salt Co. of Ithaca, N. Y., Mr. Mandeville has been engaged in the salt business for 20 years. He has been a director of Worcester Salt Co. since 1929.

H. G. Bridgewater, president of the Superior Lime & Hydrate Co. of Helena, Ala., has been chosen as chairman of the Shelby County unit of the state organization pledged to seek economy in government. Former Lieut.-Gov. W. C. Davis is state chairman.

J. C. Devilbiss, for 27 years connected with Virginia-Carolina Chemical Corp. and its predecessors, has resigned to accept a position with the United States Potash Co., which is developing potash deposits in Eddy County, New Mexico. The production headquarters of the company are located in Carlsbad, N. M., but Mr. Devilbiss will be stationed in the New York office, 342 Madison Ave.

R. C. Perkins, district engineer of the Arizona State Highway Department, has been appointed deputy state engineer, with office at Phoenix, Ariz., to succeed the late C. C. Small.

Oliver C. Irwin, for many years chief electrician of the mining department of the Colorado Fuel & Iron Co. at Trinidad, Colo., retired June 1 after 25 years of service.

Mary G. Keyes recently opened a laboratory for chemical analysis, specializing in silicate rocks and minerals, at 1512 31st St., Washington.

William W. Coleman, president, Bucyrus-Erie Co., South Milwaukee, Wis., has returned from a three-months' business trip abroad.

P. B. Verity of the New York Coal Co., of Nelsonville, O., has been elected a director of the Southern Ohio Quarries Co., and the Chillicothe Sand & Gravel Co., of Chillicothe, O., according to an announcement by **D. R. Poston,** president. Mr. Verity will be active in the management of both companies and is chairman of the executive board of each concern.

C. A. Hughett has purchased the sand-and-gravel plant and equipment of **A. L. Doran,** in Spokane, Wash.

William H. George, secretary and general manager of the Cowell Portland Cement Co., spoke before the Reno, Nev., Real Estate Assn. at its June meeting. His subject "The Value of Membership in a Builders' Exchange," is one with which Mr. George is quite familiar, since he is president of the San Francisco Builders' Exchange.

J. Frank Rollings, 2215 West Blvd., Cleveland, O., has been appointed distributor in northeastern Ohio by the Ohio Power Shovel Co. He has been engaged in the contractors'-equipment business in Cleveland for the last fifteen years and has a wide acquaintance in the industry throughout the northern part of the state. Mr. Rollings was formerly located at 1337 Schofield Bldg. He also represents the Owen Bucket Co. and the Schramm Co.

J. Frank Rollings.

Jewell Freese, sand-and-gravel producer at Spokane, Wash., has purchased a new deposit and is moving his equipment to the location, which is within the corporate limits of the city. The land and new machinery represents an investment of $20,000, it is said.

Gerald G. Dobbs, general superintendent of mines and quarries of the Tata Iron & Steel Co. of India, has been granted six months' leave and plans to visit the United States and Canada in the near future.

Obituary

Fred Phillips, 18, and **J. B. Alexander,** 20, employees in a gravel pit near Wiggins, Miss., died of suffocation when they were buried under a slide of material in the pit. Two other workmen were also caught in the slide but were resuscitated by fellow employees.

Louis N. Beckwall, for a number of years connected with the Carney Cement Co., at Minneapolis, Minn., was found dead in the garage at his home there recently. Death was due to carbon monoxide poisoning, the gas having escaped in the exhaust of his automobile.

R. M. Neeley, 38, an engineer, was found dead in a sand-and-gravel pit at Carrollton, Tex., near Dallas, recently. An empty revolver lay by his side, indicating suicide.

Coming Events

July 14, 1932. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

July 18-23, 1932. Amsterdam, Holland. Fifth International Congress for Scientific Management. Dr. L. M. Gilbreth, Montclair, N. J., official United States representative of International Management Congress Committee.

August 22-26, 1932. Denver, Colo. Eighty-fourth meeting, American Chemical Society.

October 3-7, 1932. Washington, D. C. Twenty-first Annual Safety Congress, National Safety Council. W. H. Cameron, secretary, 20 N. Wacker Drive, Chicago, Ill.

November 28-December 5, 1932. New Orleans, La. Tenth Annual Asphalt Paving Conference and annual meeting, Assn. of Asphalt Paving Technologists. Under auspices of Asphalt Institute, 801 Second Ave., N. Y.

December 5-10, 1932. New York, N. Y. Tenth National Exposition of Power and Mechanical Engineering. Under management of International Exposition Co., Grand Central Palace, New York, N. Y.

December 7-9, 1932. Washington, D. C. Annual meeting, American Institute of Chemical Engineers.

Traffic News and Comment

Recent I. C.C. Decisions

Cement.—The commission has awarded reparation on finding the rate on cement from Dewey, Okla., to Wichita Falls, Tex., unreasonable to the extent it exceeded 24 c., car-load minimum weight 50,000 lb., subject to the marked capacity of the car but not less than 40,000 lb. Claims on other shipments were barred on all issues except applicability.—I. C. C. Docket No. 24,728, Dewey Portland Cement Co. *v.* A. T. & S. F. *et al.* (PIT AND QUARRY, Nov. 18, 1931, p. 74, and Feb. 24, 1932, p. 58.)

Fluxing Stone.—New rates are ordered on crude, fluxing, foundry or furnace limestone, from Stephens City, Va., to destinations in Maryland, Pennsylvania, West Virginia, Delaware and Ohio, as a result of the commission finding that the rates on this traffic were unduly prejudicial to the complainant and unduly preferential of its competitors at Martinsburg and Engle, W. Va., to the extent the rates exceeded the rates from the West Virginia points. Rates were found to be not unreasonable.—I. C. C. Docket No. 24,823, M. J. Grove Lime Co. *v.* B. & O. *et al.* (PIT AND QUARRY, Nov. 18, 1931, p. 74, and May 4, 1932, p. 58.)

Sand.—Reparation of $473.68 has been awarded on finding that the rate on sand from Leavenworth, Kan., to New Market, Mo., was unreasonable to the extent it exceeded 3½ c. per 100 lb.—I. C. C. Docket No. 24,393, Dresser Sand Co. *v.* C. G. W. (PIT AND QUARRY, June 3, 1931, p. 68, and Feb. 24, 1932 p. 58.)

Sand and Gravel.—The commission has found the rates on sand and gravel from LaGrange and Reading, Mo., to destinations on the Alton as far north as Cheno, Ill., unreasonable. Prescribed reasonable rates are shown in an appendix to the report. The destinations involved were beyond those covered in a former case reported in 132 I. C. C. 200, the precedent established in that case controlling this decision.—I. C. C. Docket No. 24,099, Missouri Gravel Co. *v.* C. B. & Q. *et al.* (PIT AND QUARRY, Nov. 4, 1931, p. 73.)

Examiners' Report

Crushed Stone.—Examiner E. L. Glenn proposes that the commission find the rates on crushed stone from Campbell, Pa., to destinations in Maryland not unreasonable or otherwise unlawful, and dismiss the complaint in I. C. C. Docket No. 24,736, York Valley Lime & Stone Co., Inc. *v.* Pennsylvania R. R.

New Complaints Filed

Agricultural Limestone.—The commission has suspended Item 100-A, p. 5, Sup. 14 to I. C. C. F-134 of the Missouri-Illinois Railroad, proposing to reduce the rates on agricultural limestone and agricultural or refuse lime from Mosher and Ste. Genevieve, Mo., to stations in Illinois on the Missouri-Illinois R. R.—I. & S. Docket No. 3,768.

Cement.—The commission has suspended from June 22 to Jan. 22, 1933, schedules of a number of individual carriers proposing to reduce the rates on cement from points in New Jersey, New York and Pennsylvania to New York, N. Y., and intermediate points. —I. & S. Docket No. 3,767.

Violation of Sec. 1 and 15 on the shipment of cement from Ada, Okla., to Shamrock, Tex., is alleged and reparation sought in I. C. C. Docket No. 25,320, Oklahoma Portland Cement Co., Denver, Colo. *v.* C. R. I. & G. *et al.*

Cement Switching.—The commission has suspended from July 6 to Feb. 6, 1933, schedules in M. K. & T. Tariffs I. C. C. No. 710 Sup. 1 and No. 490 Sup. 16 proposing to allow the Monarch Cement Co., $2 per car out of the Humboldt, Kan., rates for switching cars to and from its plant and the tracks of the issuing carrier at Humboldt on traffic on which this carrier receives a road haul.—I. & S. Docket No. 3,766.

Lime.—New rates and reparation are sought on the shipment of lime from Capon Road (Oranda), Va., to McKeesport, Pa., on an allegation of unreasonable and illegal charges in I. C. C. Docket No. 25,346, Pittsburg Generator Co., Inc., McKeesport, Pa. *v.* B. & O. *et al.*

Plaster and Plaster-board.—Violation of Sec. 1 is alleged and reparation prayed for on the shipment of mixed car-loads of wall plaster, cement plaster and plaster-board, from Acme, Tex., to Rocky Mount, N. C., in I. C. C. Docket No. 25,323, Carolina Shippers' Assn., Inc., *et al.*, Wilson, N. C. *v.* A. C. L. *et al.*

Sand.—Alleging violation of Sec. 1 on the shipment of sand from Schuylerville, N. Y., to Ft. Atkinson, Wis., the complainant asks for new rates and reparation in I. C. C. Docket No. 25,327, Creamery Packing Mfg. Co., Ft. Atkinson, Wis. *v.* B. & M. *et al.*

Violation of Sec. 1 and 6 is alleged on the shipment of molding sand from Sandale, Ind., Bremen, O., Sandusky, O., Campbells, Ind., and Milan, O. to Franklin and Nashville, Tenn. New rates and reparation are asked for.—I. C. C. Docket No. 25,349, Allen Mfg. Co. *et al.*, Franklin, Tenn. *v.* L. & N. *et al.*

Rate-Committee Dockets

New England Freight Assn.

Stone Chips.—Carriers propose to establish a rate on stone chips or granules, car-load minimum weight 90 per cent. of the capacity of the car but not less than 60,000 lb., from Huberdeau and Lac Remi, Que., to East Walpole, Mass., of $5.30 a net ton.—Docket No. 25,361.

Trunk Line Assn.

Lime.—Carriers propose to establish the following rates on lime and related articles from the Frederick-Martinsburg-Strasburg Jct., Groups on the B. & O., to Hawk Run, Phillipsburg, Shawsville, Surveyor, Bald Hill, Frenchville, Karthans, Cataract, Spruce, Colmans Siding and Keating, Pa., on the N. Y. C.: On building lime, car-load minimum weight 30,000 lb., 17 c.; on agricultural, land and chemical lime, car-load minimum weight 30,000 lb., and on ground limestone, car-load minimum weight 50,000 lb., 16 c. per 100 lb.—Docket No. 28,309, Sup. 1.

From points in C. F. A. territory to Bridgeton and Vineland, N. J., carriers propose to establish the Philadelphia rate plus 2 c. per 100 lb., on common, hydrated, quick or slacked lime.—Docket No. 29,192, Sup. 1.

Sand.—Carriers propose the establishment of a rate of 33½ c. per 100 lb. on sand,[1] from Quail Run and Pinewald, N. J., to Drummondville, Que., in Docket No. 29,827 Sup. 1, and the same rate from Farmingdale, Lakewood, Lakehurst, Newport, Vineland and Dividing Creek, N. J., in Docket No. 29,289, Sup. 2.

The following rates from Hancock, Great Capacon and Berkeley Springs, W. Va., to Oakfield, N. Y., are proposed by carriers: On building sand,[1] $2.50 and on industrial sands,[1] $2.75 per net ton; on glass sand,[1] from Gore-Triplett, Va., to Oakfield, N. Y. $2.95.—Docket No. 29,321, Sup. 1.

Central Freight Assn.

Asbestos.—Carriers propose to establish the following rates from Danville, Sherbrooke and Warwick, Que., to Chicago, Ill., and Milwaukee, Wis., via C. N., Depot Harbor, Ont., C. A. T. Line steamers.—Docket No. 31,853:

	Proposed Rate and C-l. Min. Wt.	Present Rate
Asbestos (crude)	49½ c., 40,000 lb.	54½ c.
Asbestos (fibre)	42 c., 40,000 lb.	45 c.
Asbestos (refuse)	26½ c., 60,000 lb.	28½ c.
Asbestos (shorts)	26½ c., 60,000 lb.	28½ c.
Asbestos (waste)	27½ c., 60,000 lb.	Class.

Cement.—Carriers propose to amend the agency and/or individual lines tariffs, publishing rules governing the

[1] The car-load minimum weight will be 90 per cent. of the marked capacity of the car, except that when the car is loaded to its full cubical or visible capacity, the actual weight will apply.

stopping of car-load freight in transit partially to unload or complete loading at points in C. F. A. territory, by including "cement" in the list of exceptions to application of these rules.—Docket No. 31,918.

Crushed Stone.—Shippers are asking for the publication of a rate of $1.45 per net ton on crushed stone and related articles, from Bellevue and Sandusky, O., to South Bend, Ind., in lieu of the present sixth-class rate.—Docket No. 31,877.

Ground Limestone.—A reduction in the rate on pulverized limestone, car-load minimum weight 60,000 lb., from Sibley, Mich., to South Bend, Ind., from $2.20 to $1.70 per net ton is proposed by shippers.—Docket No. 31,885.

Lime.—Shippers propose the establishment of a rate of $6.70 per net ton on agricultural or fluxing lime, from Genoa, Luckey, Martin, Marblehead and Sandusky, O., to Jacksonville, Fla., on a car-load minimum weight of 30,000 lb., or of $5.80 per ton on a car-load minimum weight of 50,000 lb.—Docket No. 31,829.

Shippers have asked for the publication of rates on agricultural and fluxing lime, car-load minimum weight 50,000 lb., from Chicago, Ill., to points in C. F. A. territory on the basis of 80 per cent. of the scale prescribed in I. C. C. Docket No. 16,170.—Docket No. 31,958.

Sand.—A reduction in the rate on spent or refuse grinding sand, in box-cars, from Butler, Pa., to Pittsburgh, Pa., from $1.05 to 92 c. a net ton, is proposed by shippers.—Docket No. 31,880.

Sand and Gravel.—Shippers propose a reduction in the rate on sand and gravel from Symmes, O., to Maderia, Madisonville, Oakley, East Norwood, Norwood, Bond Hill, St. Bernard, Ivorydale Jct., Winton Jct., Cumminsville, Stock Yards, Cincinnati, Gest Street, Brighton, Winton Place, Fairmount, South Side, North Side (Cumminsville), College Hill Jct., to 30 c.; to Ivorydale, Elmwood Place, Carthage, Hartwell, Maplewood, Lockland, Wyoming, Park Place, Woodlawn, O., to 40 c.; to Storrs, Sedamsville, West Side, Delhi, Addyston and North Bend, O., to 50 c. The present rate is 80 c. per net ton to the points named.—Docket No. 31,849.

Carriers propose to reduce the rate on sand and gravel from Lafayette, Ind., to Thomaston, Ind., from $1.02 to 85 c. per net ton.—Docket No. 31,884.

A reduction in the rate on sand and gravel from Connersville, Ind., to Webster and Williamsburg, Ind., to 85 c. per ton and to Williamsburg, Ind., to 90 c. per ton, is proposed by shippers.—Docket No. 31,887.

Illinois Freight Assn.

Cement.—It is proposed to revise the rates on cement, car-load minimum weight 50,000 lb., to stations on the Owensboro Div., of the L. & N. Rates from and to representative points are as follows:

To Stonestreet, Ky. From:	Present	Proposed
Chicago, Ill.	15 c.	17 c.
Davenport, Ia.	17 c.	20 c.
Hannibal, Mo.	15½ c.	19½ c.
Dixon, Ill.	15½ c.	19½ c.
Utica, Ill.	15½ c.	17½ c.
To West Point, Ky. From:		
Chicago, Ill.	15½ c.	17 c.
Davenport, Ia.	17 c.	20 c.
Hannibal, Mo.	15½ c.	19½ c.
Dixon, Ill.	15½ c.	19½ c.
Utica, Ill.	15½ c.	17½ c.
To Owensboro, Ky. From:		
Chicago, Ill.	15½ c.	17½ c.
Davenport, Ia.	17 c.	19 c.
Hannibal, Mo.	15½ c.	17½ c.
Dixon, Ill.	15½ c.	17½ c.
Utica, Ill.	15½ c.	17 c.

Western Trunk Line Committee

Cement.—The present rates on cement, car-load minimum weight 50,000 lb., from Birmingham, North Birmingham, Boyles and Phoenixville, Ala., to St. Paul and Minneapolis, Minn., is 40 c.; to Northfield, Minn., 40½ c.; to Duluth, Minn., 43 c.; to Marquette, Mich., 44 c. It is proposed to reduce these rates to 39½ c.—Docket No. 6,247-C.

Feldspar.—Shippers propose the establishment of a rate of 28 c. on crude or ground feldspar, car-load minimum weight the capacity of the car but not less than 60,000 lb., from Colorado common points as described in W. T. L. Tariff No. 111-G, to Alexandria, Arcadia, Dunkirk, Elwood, Evansville, Gas City, Hammond, Hartford City, Indianapolis, Kokomo, Lapel, Marion, Noblesville, Shirley, Terre Haute, Vincennes and Winchester, Ind.—Docket No. 7,586-B.

Southern Freight Assn.

Cement.—Shippers propose the establishment of the following rule on cement at Louisville, Ky. "Car-loads of cement originating at Speed, Ind., destined to points in Southern territory, may be stopped at Louisville, Ky., to complete loading with lime; charges to be assessed on the cement at the applicable rate and minimum weight from Speed, Ind., to final destination, and on the lime at the applicable car-load rate on cement from Speed, Ind., to final destination on the actual weight of the lime, plus a stopping-in-transit charge of $6.30 per car."—Docket No. 58,178.

Lime.—It is proposed to establish on lime from Ragland, Ala., and Portland, Ga., to the destinations in Southern territory shown in Agent Glenn's I. C. C. A-684, Group 47 rates to points 100 mi. or more distant; and to points less than 100 mi. distant, also from Portland, Ga., to points to which rates are published from Ladds, Ga., rates made by use of a single- and joint-mileage scale, to be applied via the short workable route. The scales referred to will be furnished on request. Representative blocks on these scales are shown below.—Docket No. 58,206.

	C.-L. Min. Wt. (lb.) 30,000	50,000
Single-Line Distance		
5 mi. and under	$0.70	$0.56
50 mi. and over 45	1.70	1.36
100 mi. and over 90	2.40	1.92
400 mi. and over 360	3.60	2.88
700 mi. and over 680	4.40	3.52
Joint-Line Distance		
5 mi. and under	.80	.64
50 mi. and over 45	1.80	1.44
Other blocks same as single-line scale.		

It is proposed to publish rates on lime from Scotrock, Ala., to Alabama destinations, generally on the same basis as those from Keystone and Wilmay, Ala.—Docket No. 58,263.

Soapstone and Talc.—Carriers suggest the establishment of a proportional rate of 15 c. per 100 lb. on soapstone or talc, crude or ground, car-load minimum weight 50,000 lb., from Charleston and Savannah, Ga., on traffic from the Pacific coast moving through the Panama Canal, to the following South Carolina points: Spartanburg, Clevedale, Lyman, Taylors, Greenville, Fort Mill, Rock Hill, Marietta, Slater, Traveler's Rest and Ware Shoals, S. C.—Docket No. 58,277.

Offers Aid in Choice of Right Safety Equipment

The cement, crushed-stone, lime, sand, gravel and associated industries will find in the line of respirators, goggles and safety equipment, manufactured by the Pulmosan Safety Equipment Corp., Brooklyn, N. Y., effective means of protecting the lungs, nose, throat and eyes of their workers.

Due to the nature of the operations in these industries, dust, fumes and flying chips are a necessary evil. Many cases of impaired health have been traced to constant inhaling of such dusts, when adequate respiratory protection has not been provided.

The Pulmosan Safety Equipment Corp., with twenty-two years of close association with every problem of safety engineering, places its advisory services at the disposal of any plant whose men need such protective equipment. This company has abundant literature covering every type of safety equipment, which will be sent upon request.

Buys Truck Division of La France-Republic Corp.

Sterling Motor Truck Co., Milwaukee, announces that negotiations have been completed for the acquisition of the motor-truck division of the La-France-Republic Sales Corp. of Alma, Mich. Financial details have not been revealed, but the deal has been definitely approved by both boards, and will become effective immediately. It is understood net current assets free of liabilities, acquired by Sterling in the transaction exceed $1,000,000. Both lines of trucks will be continued.

Nordberg Manufacturing Co. recently moved its New York office from 51 East 42nd St. to the Lincoln Bldg., 60 East 42nd St. The company has also moved its Los Angeles office from 1462 Stanley Ave. to the Subway Terminal Bldg., 417 South Hill St.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Arundel Corp. Has Net of $600,593 in 5 Months

Arundel Corp. of Baltimore, Md., sand and gravel producers, reports for the five months ended May 31, 1932, net profit of $600,593 after depreciation, federal taxes, etc., equivalent to $1.22 a share on 492,556 no-par shares of capital stock. This compares with $871,106 or $1.76 a share in first five months of 1931.

May net profit was $107,000 after charges and federal taxes, against $224,983 in May, 1931.

Current assets as of May 31, last, were $3,466,139 and current liabilities were $307,978, comparing with $3,904,571 and $343,778, respectively, at end of May, 1931.

Schumacher Wall Board Economies Aid Earnings

Although sales volume of Schumacher Wall Board Corp., due to the continued decline in the building industry, sustained a sharp decrease, the company through operating economies succeeded in closing its fiscal year ended April 30, last, with net earnings of $21,903.43 after depreciation but before Federal taxes, A. R. Moylan, vice-president and general manager, stated in a report to stockholders.

Whereas building permits in the Pacific Coast territory decreased approximately 43 per cent. below the previous fiscal year, the sales volume of the company decreased only 38 per cent., the report stated.

In the preceding fiscal year the company reported net income after all charges and federal taxes of $78,362.81, equal after dividend payments of $2 a share on 30,172 shares of preferred stock to 27 c. a share on 66,000 common shares.

"The cash position of the company is in excellent condition, having increased over $7000 during the year," the report said. "During this period bank loans and purchase money obligations have been reduced $71,420."

Wage reductions and other operating economies effected a saving of approximately $60,000 for the year, while similar savings of Gypsum Products Corp. of Seattle, a subsidiary, amounted to about $30,000.

Kelley Island Lime Has Profit; Pays Dividends

The Kelley Island Lime & Transport Co., of Cleveland, O., reports for year ended December 31, 1931, net profit of $75,974, after charges, depreciation, depletion and federal taxes, equivalent to 24 c. a share on 308,952 no-par shares of capital stock. This compares with $515,210, or $1.66 a share, in 1930.

Current assets as of December 31, 1931, including $2,256,659 cash and government securities, amounted to $3,231,956, and current liabilities were $181,282.

The company has declared the regular quarterly dividend of 25 c. on the common stock, payable July 1 to stock of record June 20.

Consolidated balance sheet was as follows:

Assets

Cash	$ 1,714,899.02
U. S. Government securities	536,415.00
Accrued interest and dividends	25,345.63
Notes and accounts receivable	283,679.22
Investments	408,492.64
Inventory	671,618.06
Land, machinery, buildings, etc.	6,629,180.36
Investment in subsidiary companies	403,372.00
Insurance reserve funds	260,999.40
Other assets	121,623.64
Deferred	14,073.89
	$11,069,698.86

Liabilities

Accounts payable	$ 41,500.67
Accrued taxes	62,543.52
Dividend payable	77,238.00
Reserves for fire liability and contingencies	435,999.40
Capital Stock (no par)— Authorized ..... 400,000 shares Issued ..... 308,952 shares	7,723,800 00
Profit and loss surplus	2,728,617.27
	$11,069,698.86

Alpha Portland Cement Omits Common Dividend

Directors of the Alpha Portland Cement Co. have failed to act on the regular declaration of the dividend due July 25 on the common stock of the company. The last quarterly payment made was 25 c. per share. The regular payment of $1.75 on the preferred shares of the concern was mailed to holders of this class of stock on June 15.

Reduced Ballast Demand Affects Firm's Earnings

The American Aggregates Corp., Greenville, O., has reported for the years ended December 31, 1931 and 1930, consolidated income account as follows:

	1931	1930
Net sales	$1,883,355	$3,784,837
Cost of sales	1,330,314	2,400,322
Depreciation	381,650	480,344
Depletion	36,286	48,403
Selling, administrative and general expense	344,705	489,476
Operating income	209,600	366,292
Other income	*235,177	265,837
Total income	25,577	632,129
Interest and discount	118,640	173,246
Federal taxes	.....	69,700
Other deductions	.....	52,735
Net income	93,064	336,446
Preferred dividends	129,157	171,593
Common dividends	.....	167,932
Deficit	$ 222,221	$ 3,079

In commenting on the financial report, F. D. Coppock, president, in a letter to stockholders, stated:

"The earnings of the corporation during 1931 were seriously affected by the prevailing depressed economic conditions. State highway programs in most of the territories served were well maintained but, on the contrary, demand for railway ballast and general building aggregates was severely curtailed. In comparison with 1930, tonnage production during 1931 decreased approximately 16 per cent. whereas net sales declined approximately 30 per cent. reflecting the result of a more active competitive condition by reason of a restricted demand. As a result of the foregoing adverse conditions the corporation during 1931 suffered a loss of $93,063.61. However, $90,951.39 of such total loss was directly attributable to the truck-manufacturing department now in process of liquidation.

DIVIDENDS DECLARED AND AWAITING PAYMENT

Company	Class of Stock	Dividend Rate	Holders of Record	Payable	Company	Class of Stock	Dividend Rate	Holders of Record	Payable
Alpha Portland Cement	Preferred	$1.75 qr.	June 1	June 15	Owens-Illinois Glass	Preferred	$1.50 qr.	June 1	June 15
Arundel Corp	Common	$0.75 qr.	June 23	July 1	Pennsylvania Salt	Common	$0.75 qr.	June 30	July 15
Calaveras Cement	Preferred	$1.75 qr.	June 30	July 15	Pittsburgh Plate Glass	Common	$0.25	June 10	July 1
Canada Cement Co	Preferred	$1.62½ qr.	May 31	June 30	Raybestos-Manhattan	Common	$0.15 qr.	May 31	June 15
Hazel Atlas Glass	Common	$0.75 qr.	June 18	July 1	Superior Portland Cement	Class A	$0.27½M	July 23	Aug. 1
Ideal Cement Co	Common	$0.50 qr.	June 15	July 1	Superior Portland Cement	Class B	$0.12½	June 15	July 20
International Salt	Common	$0.37½ qr.	June 15	July 1	Texas Gulf Sulphur	Common	$0.50 qr.	June 1	June 15
Johns-Manville	Preferred	$1.75 qr.	June 15	July 1	U. S. Gypsum	Preferred	$1.75 qr.	June 15	June 30
Kelley Island Lime & T	Common	$0.25 qr.	June 20	July 1	U. S. Gypsum	Common	$0.40 qr.	June 15	June 30
Leslie-California Salt	Common	$0.20 qr.	June 15	July 1					

Foreign Developments

Waste Products Used in "Iron-Alumina" Cement

French patents 571,572 and 587,343 describe a process for the manufacture of "iron-alumina" cement, developed by E. Martin and assigned to the well-known producer of fused alumina cement, the S. A. des Chaux et Ciments de Lafarge et du Teil. This process, however, had at least up to 1931 not yet been employed commercially.

Under this process the residue of alumina-cement manufacture according to the Bayer process ("Bayer residue"), or also the high-iron-bearing bauxites which are unsuitable for alumina-cement making, and even pyrites scories (Fe_2O_3) are utilized along with lime in appropriate proportions as raw materials for cement manufacture. All these materials are very easy to grind and can be purchased at low prices. The process calls for burning in a rotary kiln by the wet process, although it would not be difficult to dry the residue materials if desired. The temperature required in the kiln is low, so that the process is very sparing on the kiln.

Alumina cement has been hindered from taking a large part in the cement market because of its high price, due to the expense of the fusing process and the difficulty of grinding the hard clinker. The advantages of the new process are essentially these: (1) the raw materials can be obtained as waste products at low cost; (2) the Bayer residue is already very finely divided, saving the costs of grinding; (3) the raw material and clinker are easy to grind, and the wear on the kiln is reduced; and (4) the cement produced is thoroughly sound and resistant to the corrosion of sulphate-bearing waters. Experience with this cement in practice will be very welcome. —Prof. V. Rodt in *Zement* 21:352-353, June 16, 1932.

Italian Cement Makers Resent High Power Cost

With all other factors tending both to a necessity and to a possibility of lower production and selling costs, the Italian cement industry is suffering particularly from increased expenses for electric power. This industry, as well as other consumers of power, feels that the power generators have taken advantage of their position of monopoly of the power-supply, and are calling for a better coöperation of the producers of power with the users. In 1924 electric current constituted 11 per cent. of the cost of manufacturing cement; in the next two years, during which the power cost remained at the same level but the total cost increased, the proportion of the power bill fell to 9 per cent. in 1925 and to 8 per cent. in 1926. Since then the power cost has steadily increased without corresponding increase in the total, and the proportion of the cost of power has been 9.5 per cent. in 1927, 15 per cent. in 1928, 17 per cent. in 1929, 18 per cent. in 1930, and about 20 per cent. in 1931.—Dott M. G. Cerrano in *Le Industrie del Cemento* (Milan) 29:30-31, April, 1932.

Tests Show Strength of Cement After Resetting

As a contribution to the recently-discussed question of the strength of cement ground and used after once having set, the author cites tests made over a period of years on the resetting of cement ground from specimens of several sorts, including both neat cement and mortar specimens such as are used in the testing laboratories. As a consequence of the incomplete hydration in the case of the original set, neat cement showed after the second set 41 to 78 per cent. of the original strength (in 28-day water-storage tests), and after a third set 28 to 35 per cent. The length of storage in this case seems to be without significance. Tests on the mortar specimens showed only traces of setting and strength if the original mortar mix were lean; fat mortars, however, still reached 20 to 30 per cent. of the original strengths after resetting.—Dr. F. Killig in *Zement* 21:148-150, March 17, 1932.

Favors Lime Admixture in Making of Concrete

According to the report of the Assn. of German Lime Works (Verein Deutscher Kalkwerke), that association during the past year has continued Prof. Grün's investigations on the influence of hydrated-lime admixtures on Portland-cement and blast-furnace-cement concretes. In the comprehensive report previously given to the association it was already determined that the addition of small quantities of slaked lime increased the plasticity of concrete and also its impermeability, but there was still uncertainty about its effect on the strength properties. Also, since it is well known that cements with high lime contents are in many cases more sensitive to the attack of sulphate waters than other cements, it was feared that the admixture of free lime might similarly diminish the concrete's resistance to corrosion.

In a series of comparative tests reported this year it was found that in water storage the strength properties of concrete with lime admixture, as well as of concrete with admixture of sand dust used for comparison, were in general increased. In ammonium-sulphate solution the lime admixture reduced the strength a little, although considerably less than had been expected from the corrosive action of this solution. In magnesium-sulphate solution both the sand-dust and lime admixtures increased the resistance to the salt-water attack. No superiority of lime over the inert admixture was established, but it was established that the admixture of lime did not lessen the soundness of the concrete. The investigations are being continued.—*Tonindustrie-Zeitung* 56:614-615, June 13, 1932.

French Cement Plants Serve Colonial Needs

In spite of the large quantities of cement that have been needed in the French colonies and of the widespread occurrence of good limestone, the development of local plants has not been overly rapid. About a dozen plants have been built in all the colonies combined. The most important of them is that of the Société des Ciments Portlands Artificiels de l'Indochine at Haiphong, French Indo-China, which is as modern and improved in its equipment and methods as a European plant. The output of this plant grew from 50,117 metric tons in 1913 to 149,249 in 1927. Most of the tonnage is exported—50 per cent. to China, 35 per cent. to Singapore and 15 per cent. to Hong-Kong.

In Morocco the first plant was built by the Chaux et Ciments du Maroc at Roches-Noires near Casablanca, and a second by Poliet & Chausson. Both plants were erected under European initiative, and have had a good growth. In Algeria there are a half-dozen plants producing about 150,000 tons, but capable of producing 220,000 tons. As the quantity imported into Algeria in 1930 was 237,765 tons, it is strange that the local capacity is not more fully utilized. In Tunisia the manufacture of cement has a rather long history, but the total production from several existing plants is so small as to be almost negligible.

In Senegal the cement industry has been stimulated by the success of a plant at Dakar, owned by Poliet & Chausson, which in 1929 even exported some cement. There is talk of building a plant in French Equatorial Africa, but fuel difficulties have held such a project back. In Madagascar there is a large and well-built plant which at this writing was still under construction.—Auguste Pawlowski in *Mines, Carrieres, Grandes Entreprises* 11:19-20, April, 1932.

Manufacturers' Publications

Copies of any of these publications may be had by writing the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Boilers

Coal-Fired Industrial Steam Plant Saves $33,000 a Year. 6 p. (Combustion Engineering Corp., New York, N. Y.) How the installation of two 500-hp. cross-drum boilers equipped with traveling-grate stokers effected a saving of $33,000 a year in an industrial plant, is told in an interesting manner in this booklet. Gives comparative operating figures, both before and after modernization.

Budget Control

The Manufacturing Expense Budget. 24 p. (Metropolitan Life Insurance Co., New York, N. Y.) A report based on the budgetary practices of numerous industrial organizations. The several types of budget used for control of manufacturing expense are described and illustrated and the complete procedures of four companies are outlined in detail.

Bulk-Cement Plants

Sprout-Waldron Bulk Cement Handling Equipment. 8 p. (Bulletin 632. Sprout, Waldron & Co., Muncy, Pa.) Describes and illustrates complete plants and specialized equipment for the handling of bulk cement. Included are a vertical screw elevator, cement-batch checker, cement weighing-batcher, power shovel for unloading cars, standard storage bins and bucket-elevator equipment.

Grinders

Jay Bee Industrial Grinders. Folder. (J. B. Sedberry, Inc., Utica, N. Y.) Describes in text and illustrations a line of grinding mills made in sizes from 2 to 100 hp. for the crushing and pulverizing of a wide variety of materials including asbestos, rock, shells, feldspar, gypsum, lime, mica, etc. Contains complete specification tables.

Locomotives

Atlas Electric Locomotives. 96 p. (Catalog No. 1245. The Atlas Car Manufacturing Co., Cleveland, O.) A deluxe catalog treating the entire field of electric locomotives. The subject is handled under three general headings: (1) storage battery, (2) combination, and (3) trolley locomotives. The individual machines are grouped under separate headings according to their service applications. The guarantee, on page 17, is outstanding and emphasizes the extent of the company's ability to meet individual requirements in warranting this particular type of haulage equipment.

Motors

Type AA Induction Motors—Squirrel Cage. 8 p. (Bulletin 111, Reliance Electric & Engineering Co., Cleveland, O.) The care with which this concern manufactures and assembles its squirrel-cage induction motors is described and illustrated in this publication. Supplied for two- and three-phase alternating current circuits, 40 deg. C. continuous-duty, open rating.

Separators

Raymond Small Batch Mechanical Air Separator. Folder. (The Raymond Bros. Impact Pulverizer Co., Chicago, Ill.) Describes and illustrates a small-batch mechanical air-separator for laboratory and industrial service, duplicating the larger equipment made by this concern in construction and dependability, but being smaller in size. Said to be a highly economical unit for classifying moderate amounts of powdered materials to extreme fineness and uniformity.

Vacuum Condensers

Jet Condensers and Auxiliaries for Vacuum Processes. 8 p. (Bulletin No. 411. Pennsylvania Pump & Compressor Co., Easton, Pa.) Contains a description and illustrations of the Byer design of jet condenser which effects condensation of steam by the direct contact of steam with cold circulating water. Vacuum pumps used in connection with the device are also described and illustrated. Contains a table of operating performances.

Pumpings from the Old Pit

Fifteen Years Ago

CONSTRUCTION of a plant to produce and grind glass sand was being contemplated by the Arkansas Lime Co. at Ruddells, Ark. The operation was to serve the glass-manufacturing plants located at Fort Smith.

* * *

G. E. Land was appointed advertising manager of the Blaw-Knox Co., recently formed through the consolidation of the Blaw Steel Construction Co. and the Knox Pressed & Welded Steel Co.

* * *

Ten Years Ago

FIRE practically destroyed the plant of the Canadian Crushed Stone Corp. at Dundas, Ontario, Can. Plans for the immediate rebuilding of the operation were disclosed by Col. C. M. Doolittle, in charge of production.

* * *

M. O. C. Hubbard, executive secretary of the Wisconsin Mineral Aggregate Assn., resigned that position to become affiliated with the Janesville Sand & Gravel Co., at Janesville, Wis.

* * *

The Barry Sand & Gravel Co. opened a new plant at Barry, Ill. Glen McNeal was manager.

* * *

W. R. Phillips assumed his new duties as secretary and general manager of the National Lime Assn. with offices at Washington, D. C.

The Charles Warner Co. of Wilmington, Del., acquired the controlling interest in and assumed the management of the American Lime & Stone Co. of Bellefontaine, Pa.

* * *

Frank S. Altman, field engineer at Topeka, Kan., for the Portland Cement Assn., was appointed district engineer at Minneapolis, Minn., in charge of promotional activities in the states of Minnesota, North and South Dakota.

* * *

Five Years Ago

ELVIN U. LEH, for ten years superintendent of the Trident, Mont., plant of the Three Forks Portland Cement Co., retired from active work. He was succeeded by his son, Clarke F. Leh, who had been mechanical and construction engineer.

* * *

The third self-unloading vessel to be put in service by the Huron Portland Cement Co., of Detroit, Mich., was launched when the *S. T. Crapo* entered the water at the yards of the Great Lakes Shipbuilding Co., where it was built.

Saving Through Safety

Snake Bites Workman; Only Mishap in Year

Rather Odd Accident Kept This Plant from Capturing Trophy in 1929; Successful in 1931

By C. M. CARMAN
Universal Atlas Cement Co.
Independence, Kan.

OBTAINING a perfect accident-free year for 1931 at the Independence, Kan., plant of the Universal Atlas Cement Co., was not an accident but the result of seven years of earnest effort.

After adding up the lost-time accidents for 1924 and finding that there had been 77 we set out to see what could be done towards reducing this number. Safety committees were appointed and campaigns of various kinds inaugurated in an effort to interest and educate the men. During the first years of our campaigning, we were slow in getting results. However, we did make a reduction in 1925, as our total for that year was brought down to 64. The first large decrease took place in 1926 when we more than cut our 1925 total in half and brought the total for 1926 down to 31.

We were gratified that we were making progress but we were not satisfied and we continued to stress our safety work in every possible way.

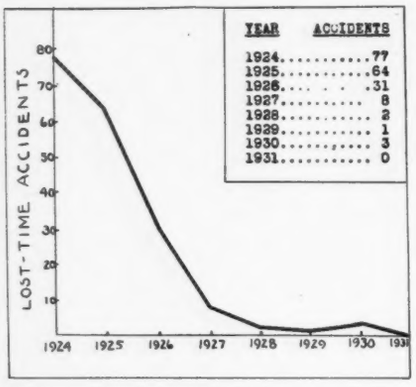


Chart showing progress in accident prevention at the Independence plant.

This resulted in bringing our total number of lost-time accidents down to 8 during 1927. At the end of that year we reorganized our safety work and determined upon a strenuous campaign for 1928. Our efforts resulted in reducing our total number of accidents to 2 for that year, involving but seven days loss of time.

In 1929 we succeeded in going through the year with but one lost-time accident involving but a single day of lost time. It is interesting to note that, in 1928, when we had the two lost-time accidents both of these accidents occurred during the first 10 days in January and that we did not have any other lost-time accidents during that year or until September of 1929 at which time our single lost time accident for that year occurred. This single accident for 1929 was rather a freak accident, but it cost us a perfect year and a safety trophy. This one day loss of time was the result of a copperhead snake biting one of our watchmen while he was on his way to our dynamite magazine.

We were feeling pretty good about our accident record at the end of 1929 as we had then made a reduction, after five years, of from 77 lost-time accidents to 1 and had reduced our number of days lost from 1,144 in 1924 to 1 for 1929. We were determined that the year 1930 should be our perfect year. However, we had a set back and suffered 3 lost-time accidents, one of which was a fatality. The two non-fatal accidents resulted in 75 days loss of time.

Our 1931 accident-free year was obtained while the plant was manufacturing clinker nine months and twenty days.

The Inspection committee usually originates safety recommendations. Bi-weekly inspections were made throughout the year by members of this committee and following the inspections recommendations would be submitted for action by the Advisory and Executive committees. Through daily meetings of department heads a constant contact was maintained with the safety work. Each foreman or department head is held responsible for the safety work in his own department.

No stunt campaign or contest was used during 1931 although in previous years we had tried out many different kinds of stunts to create and sustain interest in safety work.

A great deal of the success of our campaign can be attributed to the fact that we have been very successful in obtaining prompt reports on all accidents, no matter how trivial. The compulsory use of goggles throughout the plant has also been a contributing factor in eliminating lost-time accidents. We have an interesting and instructive bulletin board at all times and have been able to interest the men more this year than ever before.

Basic Ideas for Planning a Campaign . . . . . of Safety Education

By S. N. STEVENS
Professor of Psychology
Northwestern University

BROADLY speaking there are about two fundamental questions which may be asked regarding human behavior. Why do individuals act as they do—that is, what are the mechanisms and processes in behavior—and why do people act as they do? It is with the latter question that we are primarily concerned in the present discussion. Attempts to answer this question have been made since man first speculated regarding the origin and causes of his own acts. A completely satisfactory answer would imply the ability to predict individual action on the one hand, and the ability to control or modify it on the other. We must confess that such an answer is forthcoming in the present state of our coming knowledge.

What is the nature of those inner and outer factors which determine and control our behavior in given situations? Why do I turn my head to the source of a loud noise, stop my automobile when the traffic light flashes red, stand up when the national anthem is sung, vote for a particular candidate or read a paper before a scientific association? The blanket term "motives" may be applied to all the mechanisms in the organism, which determine our response in these and other situations. The motivated response then is one which is determined primarily by conditions or factors in the organism. Knowledge of these factors is of the greatest significance to those interested in modes of effective appeal with a view of human action.

There have been those in whom these inner factors or motives are primarily rational or logical in nature. It is assumed that man is possessed of nicely tied-up packages called ideas, as a result of experience in the world; and after a preliminary period during which these ideas are compared and arranged rationally, determined actions result. Furthermore, it is assured that some of these ideas carry with them a kind of inherent rightness or soundness, as if they were certified checks which will be in-

stantly recognized by reasonable and right-thinking persons. For example, we are presented a poster which carries the statement that carelessness is one of the chief causes of accidents, with a suggestion that the elimination of carelessness will reduce the number of accidents. This statement is undoubtedly true, the information if undoubtedly authoritative, but it carries no guarantee that the recognition of this fact will, of itself, make people careful. The idea that human action is motivated, basically, by rational processes is essentially artificial and unreal. A great many people tend to rationalize their ideal after the act has taken place but it is one of the most certain conclusions of modern psychology that, in the vast majority of our actions, there is a little in the way of preparation that may be included in which terms as, reason, judging or thinking. A safety program based on the assumption of rational motivation or human action can not be expected in the long run to yield results that will be satisfactory.

A second common error regarding the control of the factors in human behavior is that the organism reacts in a more or less mechanical way, to external stimuli. From the point of view of this conception the "right" stimuli will inevitably release the right responses, that is to say, correct information concerning the proper safety procedure or positive instruction concerning it is expected to lead to positive and desirable reactions. This will not occur unless the information or instruction is arranged to appeal to motivating factors within the individuals to whom the appeal is directed.

It is with the nature of these motivating factors that we are concerned in organizing and presenting educational material designed to promote safety and individual well-being. My reaction to the names of Gandhi, Lenin or Herbert Hoover is not explained by the fact that these words are auditory stimuli, but rather in so far as these actions present drive and intensity and determination, but the appeal which those names as symbols make to certain fundamental non-rational reaction patterns or tendencies to action. This appeal has possibly caused, to a large extent, the stereotype which the individual holds determining the nature of the impressions which he gets from the world about him. My stereotype of the Irishmen expresses my antagonism or hatred or my affection or respect. At any rate it acts as a factor so far as my impressions of an Irishman. These stereotypes may be formed as a slow accretion of impressions over a long period of time, or they may be a result of a long program of systematic propaganda. With that impression a collective attitude of a group may compel the object of the stereotype to conform to the picture. The creation

INDUSTRIAL INJURY RATES FOR 1931

	Frequency		Severity	
Industry	*Rate*	*Rank*	*Rate*	*Rank*
Total*	15.12	..	1.72	..
Cement	4.86	1	2.80	23
Laundry	6.24	2	2.75	22
Textile	9.11	3	.58	4
Printing and Publishing	9.12	4	.25	1
Automobile	9.48	5	.94	6
Machinery	9.57	6	.90	5
Non-Ferrous Metallurgical	9.88	7	1.18	11
Steel	10.87	8	2.22	20
Glass	11 31	9	.54	2
Rubber	11.78	10	1.03	9
Chemical	12.65	11	1.84	14
Public-utility	12.76	12	2.08	17.5
Tanning and Leather	13 73	13	.56	3
Petroleum	14 14	14	2.06	16
Metal Products	14.70	15	1.17	10
Railway Car and Equipment	15.48	16	2.08	17.5
Food	15.86	17	1.01	8
Electric Railway	19.73	18	1.46	12
Paper and Pulp	20.62	19	1.52	13
Ceramic	22.89	20	3.21	25
Quarry	22.98	21	6.88	27
Foundry	24.19	22	2.10	19
Marine	24.28	23	2.87	24
Meat Packing	29.13	24	.99	7
Refrigeration	32.18	25	2.00	15
Woodworking and Lumbering	33.54	26	2.60	21
Construction	48.15	27	5.14	26
Mining	57.24	28	9.44	28

* Includes miscellaneous industries not shown separately.

of these stereotypes is one of the great games of the publicity agent.

We may briefly summarize the characteristic attitudes and point out their significance to those who are trying to modify the conduct of men, women and children. Attitudes as factors in human action may be characterized as follows:

1. They tend always to express themselves in action.
2. They tend to have a strong emotional coloring.
3. They do not involve rational processes as an antecedent to action.
4. They may be conscious or unconscious.
5. Attitudes are associated with and are easily released by symbols, signs, slogans, phrases, catch-words and pictures in individual cases to build up a stereotype or mental picture in which the attitude is personalized and characterized in graphic form. Newspapers make large use of this mechanism in appeal to group attitudes. Slogans almost always appeal to attitudes. Whoever stopped to analyze a slogan? It is what the slogan implies or suggests that makes it effectve.
6. Where fundamental attitudes are involved the response is used in proportion to the intensity of the stimulus.
7. Attitudes may be developed as a result of a single experience or they may be established by a systematic and persistent propaganda. An example of the first is the establishment of an intensely negative attitude toward an individual or race as a result of a single experience. In the second case in our attitude toward safety may be established as a result of a continuous presentation of materials arranged in dramatic and dynamic settings suggesting health, well-being, efficiency and the like.

The significance of attitudes to those interested in a program of safety is obvious. The objective of such a program is the modification of conduct of men and women which may be termed as "safety behavior." Such a change can not be effected except through a change in attitudes.

We may apply the term "propaganda" to the technique involved in bringing about such a change. Propaganda has been defined as the manipulation of attitudes by means of significant symbols and has for its objectives an arousal of action in specific situations. The most effective modes of propaganda appeal are those which refer to established stereotypes. These take graphic form in pictures and symbols or the written form in slogans. One must always be certain that there is some assumed casual connection between the picture symbol or slogan and the attitude or stereotype at which the appeal is made. Safety behavior which you purpose to establish must be demonstrated in dramatic form and present in settings which connect it with the stereotypes and symbols of well-being, efficiency and so on. From a psychological point of view the function of educational and publicity organizations may be generalized as follows:

They are concerned with the development of tendencies to action, namely, attitudes. By the manipulation of significant stereotypes and the arrangement of satisfactory situations which permit the completion of actions thus initiated.

Propaganda campaigns may be divided into three classes: first, the campaign may be directed to already existing attitudes; second, the objective may be the establishment of new attitudes; and third, opposing attitudes must be overcome. All propaganda agencies make some assumption concerning the psychological makeup of the constituency toward whom their appeals are made. A fundamental problem has to do with a nature and kind of fundamental attitudes which may be assumed to be present in the beginning.

What are fundamental attitudes? The answer to this question is exceedingly hard to discover. It is exceedingly likely that no answer can be satisfactorily determined without a great amount of careful research. This is particularly true in the case with regard to fundamental attitudes as to a safety program.

Generalized attitudes are dangerous to talk about and are very uncertain in character. However, there are about three attitudes of a sufficiently general character to be presented in almost any group of men and women. One is the attitude which grows out of our desire for an adequate experience of selfhood. This often may be experienced in terms of power self

(*Continued on page 56*)

New Machinery and Supplies

Three New 6-Cylinder Trucks in Production

Mack Trucks, Inc., is actively engaged in the production of three new six-cylinder trucks, designated as the Models BM, BX and BQ, and covering a range of medium-capacity and heavy-duty, high-speed service.

The three new units bear a close resemblance in exterior design. All are characterized by a set-back front axle, which results in better load distribution, greater mileage from all tires, shorter turning radius and ease of handling, regardless of road or load conditions.

Other distinctive characteristics shared by all include gracefully crowned fenders, door-type hood ventilators, coupe-type cabs and deep radiators.

Although the smallest of the new models, the Model BM is rated as the largest medium-capacity highway freighter in the comprehensive Mack line. It is offered with dual-reduction drive only, either as a truck or tractor, wheelbases for the former being 157 in., 181 in., 199 in. and 217 in.; 138 in. for the latter. Load platforms available for the four truck wheelbases are 132 in., 156 in., 192 in. and 204 in.

Available in either dual reduction or chain drive, the Model BX is a conventional-type addition to the Mack heavy-duty line. Tractor wheelbase is 136 in. while wheelbases for the truck include 160 in. for dump-truck work and 178 in., 196 in. and 214 in. for highway-transport service.

Model BQ is dual reduction only, either truck or tractor. As the latter, the wheelbase is 156 in. and the platform 100 in. Four wheelbases are offered on the truck.

In accordance with a traditional Mack principle, the engines of these three new models develop their power at reasonable engine speeds. Thus the 4 in. by 5½ in. BM power plant produces 93 hp. at a governed speed of 2250 r.p.m., the 4¼ in. by 5½ in. BX, 104 hp. at governed speed of 2300, the 4¾ in. by 5¾ in. BQ, 127 hp. at governed speed of only 2050 r.p.m.

Designs Pneumatic Pump for Bulk-Cement Users

The new Type F Fuller-Kinyon pump developed by the Fuller Co., Catasaqua, Pa., was particularly designed for low power and air consumption and simplicity of parts, for short and medium distance conveying. It operates at very low air pressures, and, as a result of this and certain constructional details, the total power requirements compare favorably with short mechanical systems, with the benefit of power savings in longer distance conveying.

The principle of operation is exactly the same as the earlier cement-mill-type Fuller-Kinyon Pumps. The structural differences include an overhung impeller screw. The screw shaft is provided with a bushing supported in spaced bearings in a unitary mounting beyond the rear wall of the hopper, so that the screw can be removed without disturbing the bearing and dust seal assembly.

The seal of the pump may be changed from the outside by means of a novel liner bushing, which may be moved to change the distance between the terminal flight of the screw and the air ring.

The new pump is well adapted for general plant conveying, up to medium distances; for unloading bulk cement from hopper-bottom cars and as a substitute for mechanical systems for conveying from box cars, when the quantity of cement involved is too small to warrant the cost of portable Fuller-Kinyon pumping systems.

For unloading the hopper-bottom cars of the type illustrated, the pump is located in a shallow pit between the rails, and connection made through flexible canvas spouting to the flanges of the car hoppers. For conveying from box cars, the pump may be located alongside the track and the cement delivered to it by power scrapers or other conventional means.

Pump working below a hopper-bottom bulk-cement car.

The pumps are designed to operate at common induction-motor and gasoline-engine speeds by direct drive through the usual flexible couplings and without speed reduction.

These pumps are now available in a full range of capacities up to the maximum requirements of cement mills.

Develops High-Velocity Gelatin-Type Dynamite

A new type of explosive, to be known as Hi-Velocity gelatin dynamite, has recently been developed at the Eastern laboratory of E. I. du Pont de Nemours & Co. This is described as a straight gelatin that detonates at high velocity with a No. 6 cap, even when shot unconfined, and repeated tests are said to have proved that this material invariably reaches its high velocity within the first eight-inch cartridge.

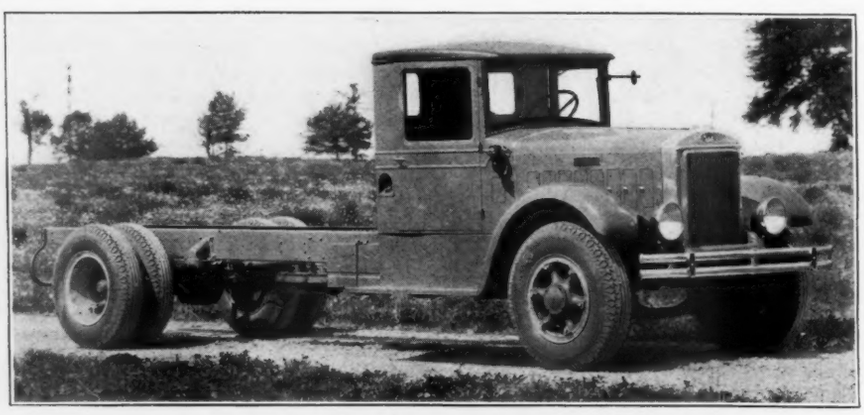
These new gelatins will be offered only in the 60-, 70- and 80-per cent. straight gelatin grades, and in diameters not less than 2¾ in.

Announces New Haulage Unit for Maximum Duty

The White Co. has announced a new super-heavy-duty tractor known as the Model 691 intended for heavy-duty hauling.

It has been especially designed to meet the new 40-ft. maximum allowance in certain states and makes possible the use in general operation of longer trailers and bodies without increasing the overall combination vehicle length.

The engine is the White 5-AD, 4⅝-in. by 5¾-in., 6-cyl. model, with a displacement of 580 cu. in. This engine is of the overhead-valve type, similar in general design to the series of over-



The Model BQ dual-reduction-drive truck.

head-valve engines manufactured by the White Motor Co. during the last five or six years. The engine has a seven-bearing counter-weighted crankshaft, with special aluminum-alloy pistons, and pressure and metered lubrication to every moving part. Special attention has been given to accessibility, and a double unit 100-per cent. oil-filter with metallic filtering elements is an integral part of the engine design. A mechanical fuel pump is driven directly from engine, as is the mechanical governor. The air compressor is mounted at the front of engine and driven directly through a splined connection from end of crankshaft. The exhaust valve seats are of the inserted type developed by the White Co., and the engine is governed at 2,050 r.p.m. Provision is made, at a slight extra cost, for the inclusion of a tachometer drive.

The transmission is a White five-speed unit with a silent over-direct drive, over-direct drive ratio being 0.715. The clutch is of the single-plate oil type.

The front axle has been specially designed with a wide tread for a short turning radius, and the rear axle is of the double-reduction type with the carrier differential-assembly doweling feature now used on all White heavy-duty vehicles. Rear axle ratios are 8.36, 10.15, and 11.85. Heavy-duty radius rods are furnished. The service brakes are of the four-wheel internal-expanding type, air-operated, and the emergency brake is of the disk type mounted at the rear of transmission.

The cooling system includes a gear-driven centrifugal pump, with a large heavy-duty tubular radiator and thermostatic control of water temperature.

The gasoline tank, mounted on right side of frame, has a capacity of 65 gal. and, at a slight extra cost, an additional 45 gal. tank can be mounted at left side.

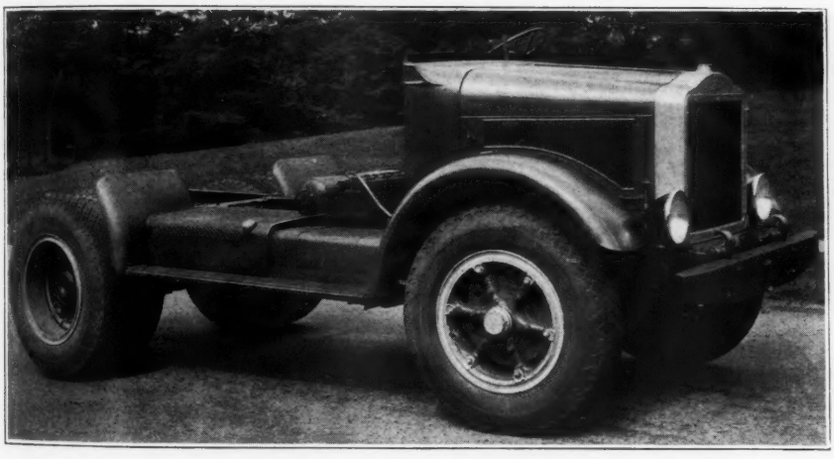
A pressed-steel, channel-section-type frame of alloy steel is used and heavy cross members are included for maximum strength. Heavy-duty tow hooks are furnished front and rear, and a heavy, channel-section pressed-steel bumper is standard equipment.

The steering has been especially designed to allow the driver to be forward of the conventional position, and the steering has been made exceptionally easy.

The standard tire equipment is 10.50/24 baloon single front and 10.50/24 balloon dual rear on cast-steel wheels.

The instruments have been arranged in the cowl for good driver visibility, and the ignition switch, spark control, and choke control are also conveniently located with reference to driver. Air gauge, ammeter, oil-pressure gauge, and heat-indicating gauge are regularly furnished.

The springs are semi-elliptic front and rear, with the double-wrapped eyes on front springs, and the slipper type at rear. Wheelbase is 129½ in. Tonnage rating is 7 to 9 tons.



The heavy-duty tractor haulage unit.

Basic Ricardo Principle Improved in New Engine

Not waiting for opportunity to present itself, but believing that there is a present active market ready for business where extra values are offered, Waukesha Motor Co. of Waukesha, Wis., has announced an entirely new line of engines of increased efficiency, smoother operation and longer life.

These new engines, the product of eight years research in both combustion-chamber design and in metallurgy, are introduced as being H. L. Horning's interpretation of the basic Ricardo principles carried to their ultimate, logical development.

Even with an ability to deliver 25 to 30 per cent. more horsepower than conventional engines of the same size, the new Waukesha Full-Power engines are more conservatively rated than previous Waukesha products. This radical departure from common practice in manufacturer's power ratings, makes it possible for the ordinary user to utilize his engine for all regular requirements without having to draw on the engine for its full capacity.

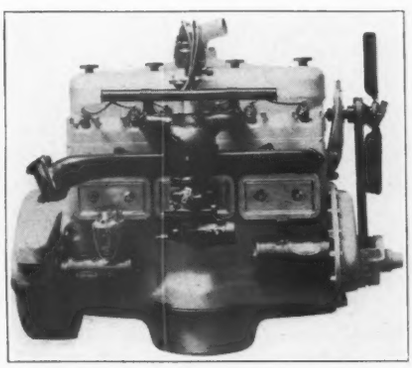
Under circumstances where the Full-Power engine is called upon for hard work and a continuous output of its full horse-power, the hazard of short life has been overcome. This has been accomplished through a stiff structural design combined with the new materials, which were developed in the Waukesha Metallurgical Laboratory, and which, the manufacturer claims, actually increase power-plant life over conventional designs in identical service.

New bearing metals of far greater durability than ordinary commercial types have been evolved for the new engine, and an improved technique in bearing manufacture has been found. This method entails special preparation of the steel surfaces of the bearing shells and connecting rods which insures perfect bonding between the bearing metal and the shell or rod itself. The bearings are integral with the connecting rods and are cast from electrically-controlled babbitt pots by centrifugal casting machines.

For the first time in the history of engines have any been made from an iron that was required to prove itself under any such exacting and gruelling conditions as the new Waukesha Alloy 221 has been forced to undergo. This super-iron used in casting the cylinder block, has the hardness of chrome-nickel steel and strength equal to that of machine steel.

The new Full-Power line ultimately will be complete for every service in which Waukesha engines are now used, and for which their standard Ricardo-head engines are built. At this moment, production is being started, or will be shortly, on three sizes of sixes rated at 90 hp., 110 hp., and 125 hp. capacity. A large four is also in production. These are to be followed as rapidly as requirements demand by other sizes.

Revolutionary as the Full-Power engines and their exclusive metals are, they are not, in the opinion of H. L. Horning, the final realization of performance ability. This will come, however, with other and better materials for which Waukesha is starting on another research which it is expected will eventuate in bringing to light even more spectacular improvements.



One of the "full-power" engines.

Adopts Improved Shunt for Enamel-Wired Caps

Adoption of a new shunt for enamel-wire, electric blasting caps is announced by Hercules Powder Co., Wilmington, Del.

The new shunt is called the "Wassen" shunt and is made by winding the end wires around a small piece of metal. It is as effective as the old type of twisted ends, and is easier to untwist and take apart without distorting the wires, it is stated.

For electric caps with plain iron or copper wires, Hercules will continue to use the eyelet shunt which has been found practical and satisfactory by blasters.

The shunting of blasting-cap wires is important to safety in blasting operations because it prevents accidental explosions from loose wires coming in contract with a source of electric current, it is explained by the explosive company's technical service division.

Special care should be exercised when using enamel wires, and particularly wires that have been cut shorter, the announcement added, as all the enamel should be carefully scraped off the ends when hooking up so as to prevent misfires.

New Incorporations

CALIFORNIA ROCK & GRAVEL CO., San Francisco, Cal. Capital $200,000. F. N. Marshall; John A. Sutro, San Francisco; Garry Owen, Berkeley, Cal.

OREGON LIME & STONE PRODUCTS CO., Genoa, O. 250 shares n.p.v. Henry E. Wight, Walter D. Skilliter, Henry W. Bergman and L. K. Chambers.

STONE MOUNTAIN CRUSHED STONE CO., Decatur, Ga. Capital $6,000. D. B. Thornton, George Weiblen and Charles F. Cromer.

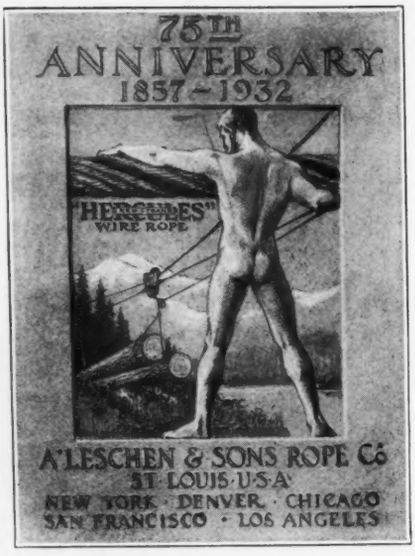
SOMERSET SAND & GRAVEL, INC., Somerville, Mass. 1,000 shares common, n.p.v. Jeremiah F. McGrath, president; R. E. Moran, 27 Linden St., Somerville, Mass., treasurer; John J. Tobin, Jr., director.

LAKE VIEW SAND & GRAVEL CO., Fond du Lac, Wis. Capital $12,000. Louise Percell, Pierce Percell and Oscar R. Mueller, all of Fond du Lac.

BURTIN CANFIELD, INC., Cedar Grove, N. J. Capital $50,000. George T. Anderson, Jr., of Paterson, N. J. To produce sand and gravel.

LIME PRODUCTS MANUFACTURING CO., Falls City, Ore. Capital $5,000. M. D. Hammell, William P. Snow and Kenneth I. Snow.

NATIONAL ROCK ASPHALT CO., Kansas City, Mo. Capital $30,000. J. O. Miller, L. C. Miller, both of Independence, Kan.



Anniversary poster adopted by the company.

Observes 75th Year as Wire-Rope Manufacturer

One of the pioneer wire-rope manufacturers who has always been a strong advocate of high quality, and who likewise has been consistent in making notable advancements in its industry, is this year celebrating its 75th anniversary. This is the A. Leschen & Sons Rope Co. of St. Louis, Mo.

An early and one of the most important developments made by the Leschen company, was in 1886 when it introduced its Hercules grade of wire rope. Prior to that time the plow-steel grade of wire rope was considered the best that could be produced. Mechanical logging was then making its appearance, as well as were dredging machines—and it was to meet the requirements of this heavy duty equipment that this new and higher quality wire rope was developed. In order that this new grade of rope could be identified by appearance, they originated the idea of coloring one of its strands—red being used.

It was not long after the introduction of Hercules (Red-Strand) wire rope that many types of wire-rope-using machines were put on the market, and almost invariably each new machine was designed with a greater capacity than its predecessor, which situation led to another forward step by the Leschen company when in 1894 they began the manufacture of wire rope in the patent flattened-strand construction. This construction is such as to provide greater resistance to wear and crushing, and it also develops greater strength.

It has long been apparent to the Leschen company that no one design of wire rope is suitable for all the conditions under which it is called upon to work, consequently this company probably manufactures wire rope in a wider range of constructions and types than any other manufacturer.

A. Leschen & Sons Rope Co. has also been active in developing wire cables to meet the requirements of the oil and gas industry, and the first successful wire drilling line was a product of this company. Later on, when rotary drilling became quite general, they applied the patent flattened strand construction to this type of equipment, with remarkable success. The deepest test well in the world, which is over two miles deep, was drilled in 1931 with a Leschen wire rope.

The Leschen idea of quality starts with the material used, and continues through to the finished product. All of its steel ropes are made of acid open-hearth steel wire. Their long contact with the wire-rope industry has made it possible for them to set correct standards of quality, and their large and complete testing laboratory enables them to make sure that their established standards are constantly maintained. The first Leschen wire rope was made by hand and an open field was the factory. Now the Leschen plant covers many acres, and the hand method has long since given way to modern machines.

Saving Through Safety

(Continued from page 53)

preservation. It is the attitude toward which most of the successful safety programs have been directed.

A second attitude is our desire for social approval. Scan the advertising in all of our magazines and one discovers that the fear motive is the power of the appeals toward social approval, social well-being and social experience. In the safety field at the present time too little has been done in establishing stereotypes or symbols on the basic of which this generalized appeal could be made.

The third type of generalized appeal based on a fundamental attitude apparently common to great groups of people is that based on insecurity. Whether that insecurity be a mental, physical or social attitude, much use has been made of this generalized attitude in most of the safety campaigns that have been carried on. Its success has been in direct proportion to the manner in which such insecurity has been symbolized through slogan or stereotype or symbol, which permitted a large range of emotional reactions to become aroused by the principle which the stereotype represents.

In conclusion, it will be well to point out that no safety campaign can be expected to produce permanent results unless the modification in the behavior of individuals, which it produces, can become sufficiently stabilized to furnish the basis for the development of definite habit patterns which will function even in the absence of the stimulation which the symbol and stereotype tends to afford.

Eighteen tons per hour from a No. 19 Crusher–100% through three-eighth inch opening using less than fifteen horsepower

THE following is the result of a test on a No. 19 Kennedy Ball Bearing Gearless Crusher.

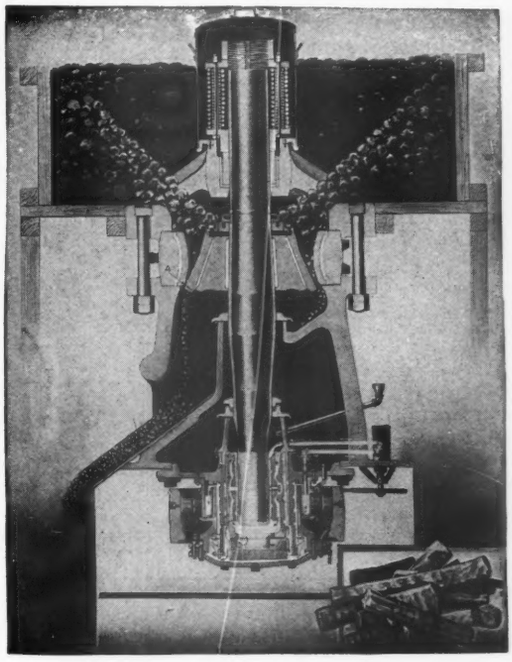
Exceedingly hard glacial gravel, 1½" and plus ⅝", was crushed for sand for concrete purposes, and less than fifteen horsepower was used.

The same crusher can be opened up and 1½" stone can be produced at a rate of from 30 to 50 tons per hour.

With the opening set to ⅛" on the closed side the following results were obtained:

Minus ⅜"	100 %
Plus 3 mesh	21½%
Minus 3—Plus 4	17 %
Minus 4—Plus 14	36½%
Minus 14—Plus 48	15 %
Minus 48—Plus 100	4 %
Minus 100	5½%

This was crushed at the rate of 18 tons per hour.



Built in various sizes with receiving openings from 1¾" to 14". Produces sizes from ⅛" to 3", with capacities up to 620 tons per hour on the larger sizes.

The Kennedy Ball Bearing Gearless Gyratory Crusher is guaranteed to do more crushing, size for size, of any given material, with less power consumption, than any crusher ever built. 90% Of the power input to motor is applied direct to breaking the rock between head and concaves. The head and shaft of the type "S" crusher is suspended on springs to permit tramp steel to pass through. The ball-and-socket eccentric is self-aligning. This crusher may be operated by a synchronous motor, built in the pulley of the crusher, or by belt from standard motor. This crusher takes one-half the power required for a geared crusher, and saves 80% in the cost of maintenance.

We manufacture a complete line of primary jaw and gyratory crushers, ball mills, rod mills, screening, elevating, and conveying equipment, etc. Complete information describing any or all of this machinery will be sent on request. *Send for latest information on our vibrating screen.*

KENNEDY-VAN SAUN MFG. and ENG. CORP.

Two Park Avenue — New York, N. Y.

BRANCH OFFICES:—Chicago: 120 South La Salle St. Birmingham, Ala.; Comer Building. Los Angeles, Calif.: 414 South Spring St. London, England: Bush House. Paris, France: 40 Rue des Mathurins. Johannesburg, S. Africa: 73 Cullinan Bldg. Canadian Agents, Canadian Fairbanks-Morse Co., 980 St. Antoine St., Montreal, Que. Walkers Limited, Maryborough, Queensland, Australia. Cuban Agents, Gerard Jansen Y Cia, Compostela 43, Havana, Cuba.

TZ REDUCTION CRUSHER
WITH PATENTED BELL HEAD AND CURVED CONCAVES

Absolutely Non-Choking, therefore ALL power used for crushing.

Do these results interest you?—

80 tons per hour to 7/16″ from 4″ feed with 70 HP

325 tons per hour to 1⅛″ from 6″ feed with 175 HP

What Do You Want To Do?

A TZ Will Do It Right!

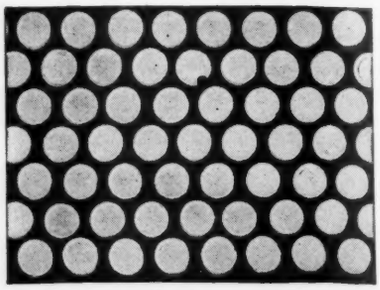
Write Us Now!

In connection with certain types of non-choking crushers, we call the attention of the public to our patent 1,837,102 issued December 15, 1931, relating to crushers of this type. We intend to enforce our rights under said patent against all manufacturers and users of stone crushers containing the features covered by said patent and to prosecute all infringers of said patent.

TRAYLOR ENGINEERING & MANUFACTURING CO.
ALLENTOWN, PENNSYLVANIA

NEW YORK 2513 Empire State Bldg. | CHICAGO 2131 One LaSalle St. Bldg. | LOS ANGELES 908 Chester Williams Bldg.
SALT LAKE CITY 101 W. 2nd South St. | SEATTLE 815 Alaska Bldg.
TIMMINS, ONTARIO, CANADA, Moore Block
Export Department, 104 Pearl St., New York City—Cable Address: "Forsaltra"

MORROW SCREEN PLATES



MORROW PERFORATED METAL SCREEN PLATES for sizing and preparing coal, sand, gravel, stone and other bulk materials are made by a Company specializing in screening machinery.

A complete set of punches and dies covering a wide range of sizes, in round, square, oval and diagonal slots are ready for the press, insuring prompt delivery of orders.

Prices are right.
Send for Bulletin 57.

The Morrow Manufacturing Co.
Wellston, Ohio

DEPENDABLE EQUIPMENT

BUILT FOR LONG, HARD SERVICE WITH LOW MAINTENANCE COST

We offer RELIANCE Crushing, Screening and Washing equipment in capacities from 50 to 1500 tons per day. Simplicity of design with low operating cost and clean separation.

CATALOGUE AND FULL INFORMATION ON REQUEST

UNIVERSAL ROAD MACHINERY CO.
KINGSTON, N. Y.
SALES OFFICES THROUGHOUT THE WORLD

LEADERS SINCE 1835

CRUSHERS—Double roll and Sledge Wedge Crushers, for practically any product. Capacities to 1000 tons an hour.

SUPER DRY PANS—For especially large tonnages.

WASHERS AND SCRUBBERS—Steel log Washers; scrubbers, cylinder washers, sand drags and washing screens.

DRYERS—Revolving cylindrical, of various sizes.

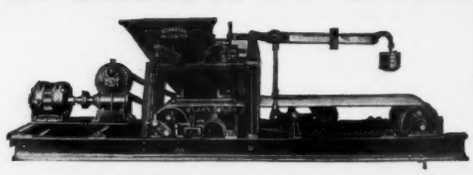
JIGS—For concentrating and beneficiating hematite and manganese ores.

SCREENS—Cylindrical and conical screens of any size and capacity.

HOISTS, ELEVATORS AND CONVEYORS—Electric, friction and gravity hoists, steel conveyors of different sizes and capacities.

McLanahan & Stone Corp.
Hollidaysburg, Pa.

PROPORTION BY WEIGHT



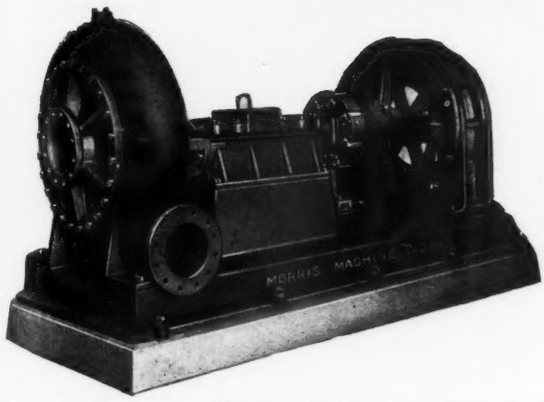
SCHAFFER POIDOMETERS will proportion your stone and clay or gypsum and clinker by weight with an accuracy of 99%.

If you have a mixing problem you would like to handle automatically and accurately it will pay you to investigate SCHAFFER POIDOMETERS.

Write for Catalogue No Twenty-five

SCHAFFER POIDOMETER CO.
2818 SMALLMAN PITTSBURGH, PA.

MORRIS
CENTRIFUGAL PUMPS



Morris Machine Works, Baldwinsville, N. Y.

Originators of centrifugal pumps, both single and multi-stage, and builders for practically all purposes since 1864

Branch Offices:—New York, 225 W. 34th St.; Philadelphia, Witherspoon Bldg.; Cleveland, Western Reserve Bldg.; Chicago, 211 West Wacker Drive; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave.; Detroit, Center Bldg.; Charlotte, N. C., Realty Bldg. Representatives in other industrial centers.

SOLIDS that scrape and scour have little effect on the tough, hard wearing surfaces of Morris Dredging Pumps. Their design and construction are based on sixty-eight years of experience in building centrifugal pumps for handling abrasive materials. These pumps operate efficiently with a lift on the suction side. All parts are massive to withstand heavy materials at high heads, and parts coming in contact with the material to be pumped are made of suitable metal to resist abrasive action. Special provisions are made to take care of wear and permit maintenance of high initial efficiency. All these and many other special Morris features combine to assure low operating and maintenance cost and highly satisfactory service. Write for bulletins.

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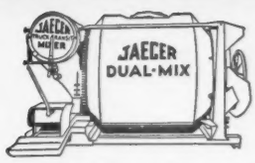
When You Go To
PHILADELPHIA at
HOTEL
PENNSYLVANIA
A Room and a Bath For Two and a Half
WE HAVE THEM
$2.50 *Single with Bath*
$4.00 *Double with Bath*

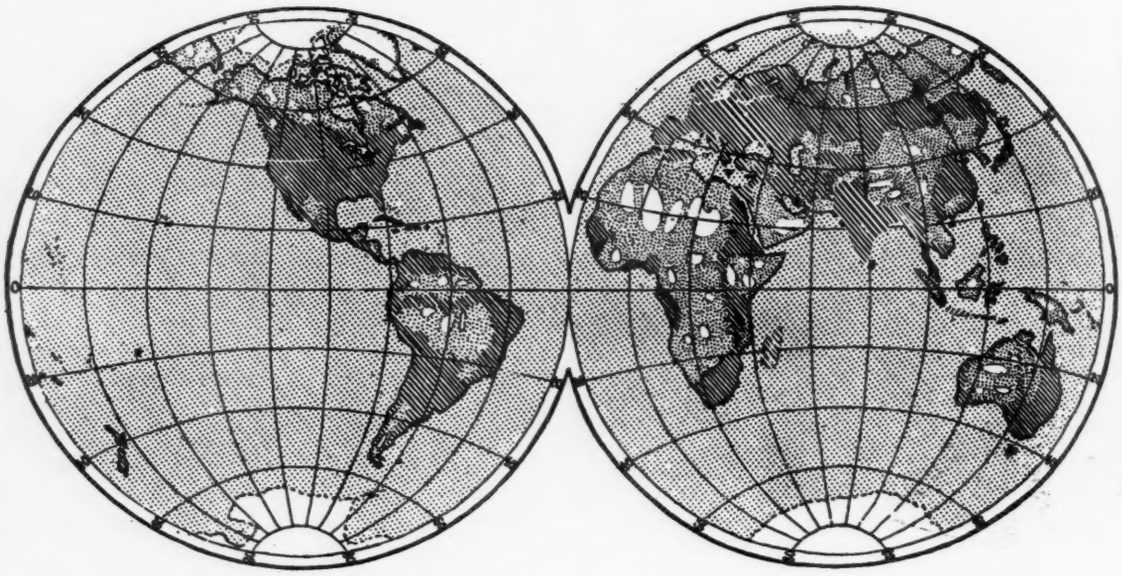
59th & CHESTNUT Sts. PHILADELPHIA

Are You Going to Establish a
COMMERCIAL CONCRETE SERVICE
for Your Customers?



WRITE or WIRE for "The Jaeger Story of Super-Concrete" and benefit by the experience of more than 100 operators serving all sizes and types of market. Address
THE JAEGER MACHINE COMPANY
602 Dublin Avenue, Columbus, Ohio
World's Largest Makers of Concrete Mixing Equipment

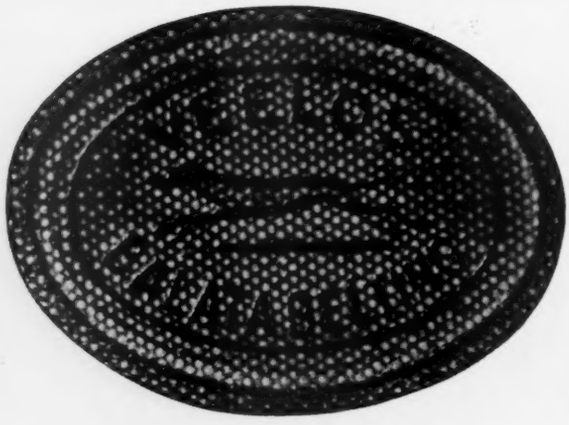
ALL THE WORLD KNOWS "CEDAR RAPIDS" IS THE BEST



"Cedar Rapids" Material Handling Equipment has been the leader in the field for many years. Our record of exceptional performance and dependable service is outstanding. Our best references are the many satisfied "Cedar Rapids" users.

We manufacture a complete line of rock and gravel producing equipment and will be pleased to quote you on your requirements.

IOWA MANUFACTURING CO. **Cedar Rapids, Iowa**



Study the Texture of "Veelos" Balata Belting

LET us send you a handy free sample so you may examine the construction of this belting material which makes it so "different" from every other kind of belting made.

Your examination of it will show you why "Veelos" is the most durable, efficient and economical belt for quarry operations. Write today for your free sample.

MANHEIM MFG. AND BELTING CO.
MANHEIM » » PENNA.

Look Through the Window...

The myriad lights of the world's motor car center gleaming against a somber background that reaches far into Canada.....

High over Detroit in a pleasant cozy room where efficient, unobtrusive attendants grant your every wish. You are in the Detroit-Leland Hotel with its unequalled splendor of interior, its famous dining room and coffee shop with electrically cooled and purified air, and its convenient location in the very center of things..

800 ROOMS
all outside, with bath..
every conceivable comfort
an address of distinction
all at ordinary hotel cost

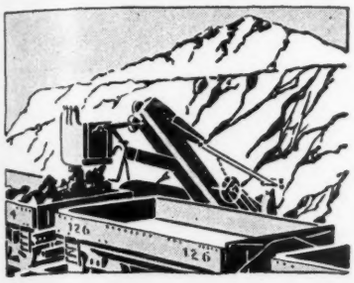
$2.50 and $3.50

CASS *and* BAGLEY AVENUES

DETROIT HOTEL DETROIT-LELAND

BAKER-OPERATED

DIXONS



DIRTPROOF AND STEAM PROOF TOO..FOR JOBS LIKE THIS

Are you protecting the life of your costly equipment by keeping dirt, water, steam, etc., out of the bearings. You will be glad to know that you can—with Dixon's Waterproof Graphite Grease. This lubricant has flake graphite as the vital, wear-resisting element combined with high-grade lubricating stock—double insurance of better lubrication.

Use Dixon's Waterproof Graphite Grease on chains, wire ropes, gears, heavy bearings, etc., especially where exposed to the weather or difficult operating conditions. Get acquainted with this unusual lubricant and you will find out the wisdom of using it regularly. Write for Circular No. 136-W.

Joseph Dixon Crucible Co.
Established 1827

Jersey City D X N TRADE MARK New Jersey

MAXIMUM
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ECONOMY
SAFETY

HERCULES
EXPLOSIVES

HERCULES POWDER COMPANY
WILMINGTON DELAWARE

A-24R

A BRADLEY 16 SEPARATOR

In the Raw Grinding Department of the **GIANT PORTLAND CEMENT CO.**, Egypt, Pa., in combination with **BRADLEY HERCULES MILLS** and Tube Mills shows these Results:

Production increased 85%
Power consumption reduced 21%
(This saving amounts to over $1,000.00 per month)

The Total Power Consumed in the Entire Department, Including Dryers, Elevating and Conveying Machinery Amounts to 16.47 K.W.H. per Ton.

This Installation Produces 48 Tons of Kiln Feed per Hour, Reducing Cement Rock and Limestone from 2″ to 90% through 200 Mesh Screen.

Further Information on This and Other Installations Will Gladly be Furnished Upon Request

BRADLEY PULVERIZER CO.

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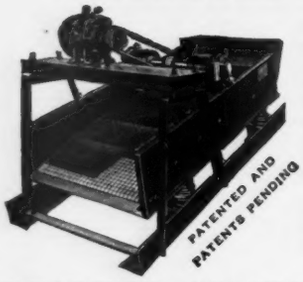
Works: ALLENTOWN, PA.

European Mfgr.—Etablissements Fernand Poitte, Paris

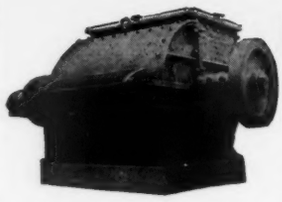
PLAT-O
VIBRATING SCREEN



Produces with high efficiency and accuracy larger tonnages per square foot of effective screening area than any other machine of its kind. Differential conveying action of Plat-O Screen permits operation at very flat angle. Controlled action of screen cloth greatly increases capacity output.

All popular sizes, single, double, and triple deck. Send for our New Bulletin.

DEISTER MACHINE COMPANY
1933 EAST WAYNE STREET FT. WAYNE, IND.

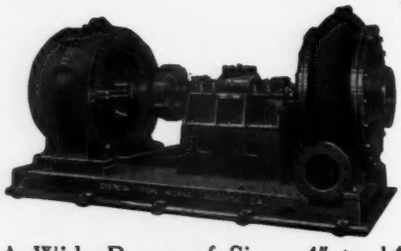


Economical, with Maximum Efficiency

Because of correct design and sound engineering principles, the Gruendler Swing Hammer or Ring crusher is an important factor in economical operation. Roller bearings save 95% on lubrication and 30% to 40% power consumption. Catalog No. 30 explains—*may we send it?*

Gruendler Crusher and Pulverizer Co.
Dept. PQ ST. LOUIS, MO.

SAND AND DREDGING PUMPS



A Wide Range of Sizes, 4" to 14"

Send for illustrated booklet

GEORGIA IRON WORKS, AUGUSTA, GA.

Lewistown Foundry Products ARE
Performance-Tested

BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.

SIMPLICITY DEPENDABLE COLD MIX ASPHALT PLANTS FOR QUARRIES SIMPLICITY DEPENDABLE

THE SIMPLICITY SYSTEM COMPANY
CHATTANOOGA, TENNESSEE

ALLEN
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ACCURACY

Allen Sand Cones operating in series give you two or more grades of sand that are absolutely accurate in classification. Why experiment when we will be glad to advise you of the grade or grades your bank is capable of producing—quantity of water required for washing and other facts.

Send samples of your sand for accurate report. Do it now.

Allen Cone & Machinery Corp.
ENGINEERS
30 Church Street New York City

Perforated Metals—Screens of All Kinds—For Sand, Gravel, Stone, Etc.

MATERIAL IN STOCK
PROMPT SHIPMENT

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Advertise your wants and surplus equipment in

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Perforated Metals ++

FOR LONG WEAR AND FAST PRODUCTION

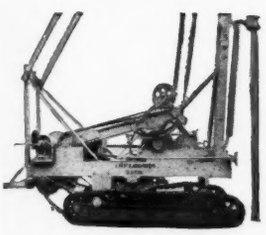
PERFORATED SCREEN sections or plates for Revolving, Vibrating and Shaking Equipment
Special Alloy, Manganese, or ordinary Steels. Rounds, squares, slots, or any design perforation
Buckets, Conveyor Trough, Chain, Replacement Parts, Rubbish Burners, Fabricated Steel Plate Work

Send your specifications for our low prices

Expert Workmanship—Prompt Shipments—Satisfaction Guaranteed

CROSS ENGINEERING COMPANY
Carbondale, Pa. +

Can Drilling Costs be Lowered?



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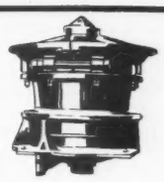

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Several Jaw Crushers.
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